

1982 - 1984

PERFORMANCE REPORT

FROM

WATER QUALITY SECTION

VOLUME 1

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1984



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Ministry  
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1982 - 1984  
PERFORMANCE REPORT  
FROM  
WATER QUALITY SECTION

VOLUME I

Water Quality Section  
Laboratory Services Branch  
Ministry of the Environment

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#### ACKNOWLEDGEMENT

This report is dedicated to the technicians of the Water Quality Section who, in the pursuit of quality data for their customers, performed the one-half million analyses summarized in this report. The magnitude of this task is apparent when one realizes that each datum required analysis, graphical representation, evaluation, and transfer of result to a microcomputer.

and

we gratefully acknowledge the contribution of Michael VcVicar who created additional software for successful editing of the three years' data and for the production of the final version of the performance reports.

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The Water Quality Section of the Ministry of the Environment, Laboratory Services Branch is responsible for high production analysis of water quality parameters. By using suitably sensitive instrumentation and methodologies in conjunction with carefully planned and monitored quality control and quality assurance programs, the Water Quality Section is able to maintain a high standard of analytical performance. This performance is certified through regular participation in interlaboratory round-robins. While results on these round-robins (i.e. IJC, USGS, LRTAP) are not included in this report, they are available on request. This report does provide an outline of the Quality Control program, and a summary of performance data for the period 1982 to 1984 inclusive.

### Quality Control Program

The major objective of the Quality Control (QC) program is to ensure immediate detection and correction of unacceptable analytical performance. In practice QC activities are divided into continual checks of basic analytical tools such as chemicals, water purity, containers, etc. and daily checks of instrumentation, calibration, recovery, etc.

The quality control program for chemicals involves the purchase of high purity materials, and regular analyses of these chemicals for contamination. An understanding of their shelf lives and health effects is a vital part of this program. Distilled and deionized water sources are monitored daily for conductivity and dissolved organic carbon. Lines carrying these water supplies are inspected regularly and replaced when necessary. Stability studies for all solutions, whether reagents or standards, are conducted regularly, and the data are utilized to specify shelf-life in method descriptions.

Sample containers, filters, glassware and any other equipment used in the collection and analysis of samples are checked for leaching, adsorption and contamination. The effects of sample storage and preservation are also studied. The laboratory publication "A Guide to the Collection and Submission of Samples for Laboratory Analysis" contains recommendations for sample containers, preservatives and sampling techniques.

The first of the daily checks is generally an instrumentation check. Each instrument must be in good working order before an analytical run can commence. A careful record of all maintenance is kept for each workstation.

While a quality control program must encompass all the facets listed above, the greatest effort is probably expended on calibrating the system (procedural step) and checking the calibration (QC). Calibration is achieved using standard solutions covering the analytical range, and is performed before the analytical run commences. Since high degrees of both accuracy and precision are required to detect and minimize any between-run changes, standards are analyzed with as little handling or preparation as possible. The following steps are taken when setting up most of the analytical instruments.

- 1) Distilled, deionized water (or other appropriate blank) is analyzed to adjust the baseline, or zero setting of the instrument, to a suitable region on the chart recorder or other readout.



- 2) If the system is known to be linear and stable, a high standard at 80% of full scale is analyzed at least twice. When the baseline and high standard have been set, a low standard of 10% -20% of full scale is usually analyzed. An incorrect reading for the latter requires an investigation: the problem may be curvature of the calibration, contamination of the blank water or improper preparation of one of the two standards.
- 3) If the system is known to have a non-linear calibration, several standards are required. A daily calibration curve is developed from these data.

N.B.: Throughout the remainder of this report, the upper concentration of the calibrated range will be referred to as full scale.

Once the system has been calibrated, quality control begins. Depending on the analytical procedure, one or more of the following QC checks is conducted: calibration control, blank control, recovery efficiency, control of potential interferences, and analyses of duplicate aliquots from samples. In addition, calibration standards (sensitivity checks) are interspersed throughout the run.

#### Calibration Control

The calibration is confirmed by means of two control standards QCA and QCB and a long term blank (LTBL) which are made up and maintained independently of the calibration standards. The system is not calibrated with these solutions. QCA and QCB are chosen to be about 70% and 20% of full scale respectively. The long term blank is the water plus any reagent chemicals used in the preparation of QCA and QCB. While working calibration standards may be prepared daily or weekly, the control standards are used for long periods of time. Since the calibration solutions are prepared so often, there is a chance that errors in preparation may occur from time to time. By checking the calibration with control standards, errors in the calibration standards can be detected.

When the control standards are analyzed, their sum (A+B) and difference (A-B) are plotted versus time on a control chart and used immediately by the technician to determine whether the calibration process is in control. The control limits against which the daily A+B and A-B values are compared are determined from practical experience. They should not be set too much tighter than the system to which they are applied can tolerate nor should they be set much looser than long term data suggests can be routinely maintained. In general, the daily A+B and A-B values are allowed to vary by  $\pm 2.25$  to 4.5% of full scale and  $\pm 1.5$  to 3.0% of full scale respectively. If either the sum or the difference is out of control, the system is stopped, corrective action is taken and the control standards are re-analyzed.

The actual values of QCA and QCB are examined whenever the sums or differences are out of control, but they are not themselves separately controlled. Over the long run, the standard deviations of QCA and QCB are used to estimate the between run standard deviation (S) and its dependence on concentration. In many systems, the in-run standard deviation (SW) is not particularly concentration dependent, although the between run standard deviation may be. Values for S and SW can be calculated as follows:

$$2(SW)^2 = (s.d._{A-B})^2 \qquad 2S^2 = (s.d._A)^2 + (s.d._B)^2$$

where       $s.d._A$       = standard deviation of QCA between runs  
               $s.d._B$       = standard deviation of QCB between runs  
               $s.d._{A-B}$  = standard deviation of QCA-QCB between runs

N.B.: If a second range is employed for a test, two more QC control standards are used. These are QCC and QCD and are 80% and 20% for the lower range full scale.

N.B.: For a detailed description of the A/B control process, the reader is directed to references 1,2 and 3 given in the bibliography.

#### Recovery Checks

In methods where sample preparation such as digestion or extraction is required, a recovery check suitable to that system is required to estimate the efficiency of the analysis. These solutions are not used to calibrate the instrument, but corrections for the digestion blank and matrix effects are estimated and applied if necessary.

Recovery standards are chosen to test all facets of the analysis. If a digestion step is supposed to liberate a substance or convert one substance into another before analysis can take place, then the recovery standard is chosen to test the efficiency of this step. For example, glycine is used to test the efficiency of the digestion step in Total Kjeldahl Nitrogen analyses, and pyrophosphate is used in the Total Phosphorus test. Without pre-treatment (in this case, digestion) these chemicals give a zero response in their respective tests. Duplicate standards are prepared at 0%, 20%, and 80% of full scale. These recovery standards are then analyzed daily in the same manner as regular samples. The percent recovery can be calculated by:

$$\% \text{ Recovery} = \frac{\text{Measured Value}}{\text{Theoretical Value}} \times 100$$

The 0% standard is referred to as the digested blank and the 80% and 20% standards are referred to as  $R_1$  and  $R_2$  respectively. For an analytical run to be accepted,  $R_1$  and  $R_2$  must be within 95% and 105% full scale of their expected values and the average digested blank must be within three standard deviations of its mean.

N.B.: If a second range is employed for a test, at least one additional recovery standard is used.

#### Sensitivity Checks

By analyzing in-run standards throughout the run, the analyst can monitor changes in reagents, laboratory temperature, etc. To do this, a blank and a high standard are run after every twenty samples and the results are compared to the original calibration standards. These checks may be run more frequently where required. Several tests performed on automated equipment suffer from baseline shift throughout the run due to reagents coating out on the glassware.

A gradual increase in peak height of the low and high standards may be due to increasing laboratory temperature while gradual decreases in the peak heights may be due to decreasing temperature or/deterioration of the reagents. Sudden shifts in sensitivity are viewed with suspicion. For example, a sudden increase in sensitivity in the ammonia test may be due to using an ammonia type cleanser in the laboratory. The baseline should not shift more than 5% of full scale over the course of the entire run. For most linear systems sensitivity changes within the 5% limits can be corrected mathematically.

### Interference Checks

Interference checks are run on any test where a material may to be present in large enough concentrations to affect with the results. These checks are used to monitor how well the effects of these materials are minimized.

N.B.: The Water Quality Section does not perform spike checks on a routine basis although they may be included in the method development.

### In-Run Duplicate Data

Natural samples are selected on a regular basis for nonadjacent within-run duplicate analysis. Generally, one sample out of twenty is run in duplicate up to a maximum of three per day. One sample of each pair is analyzed at the beginning of the run with the QC and Recovery standards. The other sample of the pair is analyzed in the regular sample order. By analyzing samples in duplicate, the analyst can estimate his ability to obtain repeatable analytical results within a short period of time. The observed differences in duplicate results, for all the duplicates samples, are accumulated and sorted according to sample concentration span. A standard deviation is then calculated for each of these concentration spans using a computer program.

Widely varying results for duplicate analyses of the same sample may signify a breakdown in the analytical system. For a run to be accepted, the duplicate results must be within three standard deviations of each other.

## Format For Performance Report

The types of samples analyzed in the Water Quality Section include ground waters, surface waters, sewage, industrial wastes, leachates, soil extracts, drinking water, drinking water sources, and precipitation. In order to handle these varied sample types, the section is divided into a number of laboratories each responsible for one or more sample types. The Laboratory Information System (LIS) is a centralized computer system which routes samples to the proper laboratory and to a specific workstation.

There is a performance report for each test in each of the laboratories where the test is performed. Information is provided to assist the reader in identifying the data which is appropriate to the various sample types and classes. The performance reports consist of a general summary sheet for the parameter in question followed by one or more sheets of data tabulated for the years 1982, 1983 and 1984. The remainder of this section outlines the type of information which is included in the individual performance reports.

### SUMMARY SHEET

#### Title:

This gives the name of the parameter in this particular performance report.

#### Identification:

##### Laboratory

This gives the laboratory where the test is performed on the sample types listed below.

##### LIS Test Name Code

This is the computer code name for the particular parameter, i.e. the code the sampler would see on the final data reports.

##### Workstation Code

This is the computer code for the workstation to which the sample has been routed.

##### Method Code

This is the computer code for the analytical procedure which is used at the above workstation.

##### Method Introduced

This is the date (given as Day/Month/Year) on which this particular method was implemented in the above laboratory.

##### Units

These are the units in which the results are reported e.g. mg/L as N.

##### Unit Code

This is the computer code for the units.

##### Supervisor

This is the name of the supervisor responsible for the laboratory given above.

### Sample Type/Matrix

This section lists the various sample types that are accepted at this workstation.

### Sampling:

This gives a brief description of the type of bottle to use, what preservatives to use if any, and also the minimum volume of sample that the laboratory requires to do the test. Any sample preparation which must be performed by field personnel is also listed.

### Sample Preparation:

This section lists only manual sample preparation techniques (i.e. filtration or extraction) which must be carried out at the laboratory.

### Analytical Procedure:

This section gives a brief description of the analytical method used to test the parameter in question. For detailed method descriptions the reader is referred to reference 4 in the bibliography. The methods described in this section are up to date as of December 1, 1984.

### Instrumentation:

This section gives a brief listing of the instruments used to perform the test. Detailed instrumentation is given in reference 4. Many of the descriptions given will include reference to automated modular continuous flow systems. Such systems consist of an automatic sampler, peristaltic pump, manifold for reagent addition, detection system and an output system such as a chart recorder or printout. The detection system is at least one of the following: colourimeter, scanning spectrophotometer, ion chromatograph, atomic absorption spectrophotometer, conductivity meter, pH meter, or specific ion electrode plus meter. Use of micro-computers to control operation of analytical equipment and/or data acquisition is identified.

### Reporting:

This section gives the maximum number of significant figures used to report the result. If an analytical result is determined to be zero, the Water Quality Section reports the MINIMUM INCREMENT (W) in this place. This is done so that the data user can have some idea of how small an analytical result we could determine. For tests using strip chart recorders, which are read manually, W is typically set at 0.5% of full scale. The DETECTION CRITERION (T) is a value obtained by statistical manipulation of data obtained from the analyses (within run) of duplicate aliquots of the same sample. This value does not imply any guarantee on the validity or accuracy of an analytical result, but it can aid the data user in testing the validity of statements made about a given analytical result or environmental situation. The analyst wishes to warn the data user that a given result is so low that there is a reasonable chance that the value could be zero. If an analytical result greater than the detection criterion is obtained, the risk of making a Type 1 error, i.e. of reporting something as present when in fact it is absent, is less than 5%. The detection criterion is determined by multiplying the standard deviation for the lowest concentration span of the duplicates by 1.645.

### Calibration:

This section lists the number of standards used to calibrate the analytical system daily.

### Controls:

This section lists the control checks used throughout the analytical process. The CALIBRATION control standards QCA, QCB, QCC and QCD and LTBL are used to monitor the calibration. The RECOVERY controls are used to monitor the efficiency of the overall test. These are the R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub> and digested blank standards.

The DRIFT controls are the standards which are used to monitor the instrument stability throughout a run. The number of standards used is given and the frequency of their usage is given whenever the latter differs from "every 20 samples".

The INTERFERENCE controls are those solutions which are analyzed to monitor the efficiency with which the effects of potential interferences are eliminated.

### Modifications:

This section lists any modifications to the test since the publication of "Handbook of Analytical Methods for Environmental Samples" (HAMES). (Reference 4).

### NOTES:

Any explanatory notes which the analyst feels may aid the data user in interpreting the information provided.

N.B.: If any of the above headings has been omitted from a particular summary sheet, the reader should assume that such headings are not applicable to this test.

## PERFORMANCE DATA

For each performance report there will be at least one tabulated data page to cover the years from 1982 to 1984.

### Title:

This gives the name of the parameter in this particular performance report.

### Quality Control Data From:To:

These dates specify the collection period for the data tabulated on this page. Dates are given as day/month/year.

### Lab:

This lists the laboratory in which this data was collected.

### Analytical Range:

The analytical range in concentration units is given. The range normally covers the span from the detection criterion to 100% of full scale.



### Calibration Control:

This section tabulates all the data collected for the calibration control standards (QCA, QCB, QCC and QCD). The table headings give the number of data points collected, the expected concentration for each control standard as well as their sum and difference; the average concentrations measured, the bias (difference obtained by subtracting the expected concentration from the average concentration measured); and the standard deviation calculated for each standard, their sum and their difference.

The within run standard deviation (SW) and the between run standard deviation (S), the ratio S/SW and the ranges for which the day's A+B and A-B values are judged to be acceptable are also shown.

N.B.: If the system employs two analytical ranges, values for QCC and QCD are also given.

N.B.: All data are reported in the concentration units shown at the top of the page unless otherwise stated.

### Recoveries:

This section tabulates the data collected for the recovery control standards (R<sub>1</sub>, R<sub>2</sub>). The number of data points, the expected concentration, the average measured concentration and the calculated standard deviation are listed for each recovery standard. If no recovery checks are performed, this section is omitted.

N.B.: All data are reported in the concentration units shown at the top of the page unless otherwise state.

### Duplicates:

This section tabulates the data collected from the analyses (within run) of duplicate aliquots from the same sample. The number of data pairs used, the sample concentration spans into which the analyses were sorted, the mean standard deviation and the relative standard deviation for each span are given. The relative standard deviation (%) is obtained by dividing the mean standard deviation for a particular span by the midpoint of that span and then multiplying by 100.

N.B.: All data are reported in the concentration units shown at the top of the page unless otherwise stated.

### Detection Criterion:

The detection criterion, which is based on duplicate data, is calculated by multiplying the mean standard deviation for the lowest concentration span by 1.645. In some years the amount of such data is insufficient, and thus the calculated detection criterion is suspect.

### Other Checks:

This section lists data for checks such as the long term blank, digested blank, standard cal settings on colorimeters, etc. The number of data points, the data mean and the calculated standard deviation are given.

## BIBLIOGRAPHY

1. Laboratory Services Branch, Data Quality Report Series, Quality Control and Data Evaluation Procedures, Section 1, Analytical Reproducibility. 1976. D.E. King.
2. Laboratory Services Branch, Data Quality Report Series, Quality Control Procedures and Objectives. 1976.
3. Laboratory Services Branch, Quality Control Report - A80. Water Quality Section. 1980. W.B. Moody.
4. Laboratory Services Branch, Handbook of Analytical Methods for Environmental Samples. 1984. (HAMES).
5. Laboratory Services Branch, Outlines of Analytical Methods. 1981.
6. Laboratory Services Branch, A Guide to the Collection and Submission of Samples for Laboratory Analysis. 1979.
7. Laboratory Services Branch, Protocol for Quality Control in the Water Quality Section. 1983. W.B. Moody.



## APPENDIX - A

### Responsibility for QC/QA Tasks

The supervisors for the Water Quality laboratories and their unit leaders or senior technicians are:

Manager	- Larry Vlassoff
Domestic Water Laboratory	- Michael Rawlings - Stuart Barnes
Precipitation Laboratory	- Michael Rawlings - Jenifer McBride
Rivers and Lakes Laboratory	- Joan Crowther - Walter Wright - Stella Tracy - Abraham "Pete" Millar
Sewage and Industrial Waste Laboratory	- Peter Campbell - Ben Cheung - Vera Turner
Dorset and Mobile Laboratory	- Frank Tomassini - Charlie Chun (Dorset) - Peter Wilson (Mobile)
Electron Microscopy Unit	- Rusty Moody - Olaf Lindow
Radiochemical Unit	- Rusty Moody - Sathi Selliah

The supervisors listed here are members of the Water Quality Section's QC/QA Technical Committee which reviews the quality of the analytical data and makes recommendations to improve the quality. The committee also conducts a new method review and acceptance process.

## APPENDIX - B

### Glossary

AAS	- Atomic Absorption Spectrophotometer
Abs	- Absorbance
Av	- Average
BL	- Blank
C	- Degrees Centigrade
cm	- Centimeter
Concn	- Concentration
Date	- Day/month/year
DDW	- Distilled, deionized water
DW	- Distilled water
FTU	- Formazin Turbidity Units
g	- Gram
HAMES	- Handbook of Analytical Methods for Environmental Samples, M.O.E.
HOAC	- Acetic Acid
HZU	- Hazen Units
L	- Liter
LAB	- Laboratory
LIS	- Laboratory Information System
LTBL	- Long Term Blank
M	- Molar
mg	- Milligram
mil	- One-thousands of an inch
min	- Minute
mL	- Milliliter
mm	- Millimeter
N	- Normal
N/A	- Not Available
nm	- Nanometer
oz	- Ounce
QC	- Quality Control
rpm	- Revolutions per minute
S	- Between run standard deviation for QC

## APPENDIX - B (Continued)

### Glossary

Sw	-	Within run standard deviation for QC
s.d.	-	Standard deviation
S. class	-	Weights that have not been officially calibrated within past six months
Standard Cal	-	Colourimeter setting controlling electronic expansion
STD	-	Standard
TCU	-	True Colour Units
u	-	Micron or Micrometer
ug	-	Microgram
uS	-	Micro-Siemen
V/V	-	Concentration based on volume measurements

\*\*\* ACIDITY - GRAN \*\*\*

IDENTIFICATION:

Laboratory	: Precipitation	Method Introduced:	01/08/82
LIS Test Name Code:	ACDG	Units	: ug/L as H
Work Station Code	: PHACD	Unit Code	: 063801
Method Code	: 001BT5	Supervisor	: M. Rawlings
Sample Type/Matrix: Precipitation, Throughfall, Stemflow			

SAMPLING:

Quantity Required: 15 mL  
Container : Polystyrene

ANALYTICAL PROCEDURE:

Sample aliquots (10.0 mL) are titrated with 0.01N sodium hydroxide to a pH >8.3. The titrant is standardized against 0.005N potassium hydrogen phthalate. The titrant delivery rate is determined from the slope of the titration curve and the stability of the pH readings following each aliquot of titrant. Data are subjected to Gran analysis.  
N.B. pH and total fixed endpoint acidity are determined simultaneously.

INSTRUMENTATION:

Automated modular titration system with microcomputer control and data reduction software.

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.1                      Detection Criterion (T): 7

CALIBRATION:

2 standard buffers covering the pH range of 4 to 7.

CONTROLS:

Calibration : LTBL plus two standards, eg, QCA

MODIFICATIONS:

01/08/82- QC program was expanded to include Gran acidity for which the reporting units are ug/L as H.  
01/05/83- System was fully automated by introduction of a sampler, and an automated device for washing the electrode between analyses.

# ACIDITY - GRAN

QUALITY CONTROL DATA FROM 03/01/84 TO 21/12/84

LAB: Precipitation

Analytical Range: 7.2 to 1000 ueq/L as H

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	156	499.5	498.9	-0.6	8.36
B :	156	199.8	202.1	2.3	7.50
A+B :	155	699.3	700.9	1.6	15.05
A-B :	155	299.7	296.8	-2.9	5.17

s.d(AB): Sw(within run): 3.66

S(between runs): 7.94

S/Sw: 2.17

On any given day the calibration is accepted if the values obtained lie within the ranges:

669.3 to 729.3 for A+B  
279.7 to 319.7 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
53	0.0 - 40.0	4.40	21.98
122	40.0 - 250.0	6.47	4.46
3	250.0 - 500	3.0	0.80
2	500 - 1000	1.4	0.19
180	Overall	5.9	N/A

DETECTION CRITERION: 7.2

\*\*\* ACIDITY - TOTAL FIXED ENDPOINT (TFE) \*\*\*

IDENTIFICATION:

Laboratory : Dorset Method Introduced: 16/08/82  
Supervisor : F. Tomassini Units : mg/L as CaCO<sub>3</sub>  
Sample Type/Matrix: Streams, Precipitation, Groundwaters

SAMPLING:

Quantity Required: 25 mL  
Container : Polyethylene bottle filled to the brim; screw caps with  
cone-shaped liners are preferred

ANALYTICAL PROCEDURE:

Samples (10.0 mL) are titrated with 0.01 N sodium hydroxide to a pH endpoint of 8.3. The titrant is standardized against 0.005N potassium hydrogen phthalate. The titrant delivery rate is determined from the slope of the titration curve and the stability of the pH reading following each aliquot of titrant.  
N.B. pH and Gran acidity are determined simultaneously.

INSTRUMENTATION:

Semi-automated modular titration system with microcomputer control and data reduction software.

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.01 Detection Criterion (T): 0.2

CALIBRATION:

2 standard buffers covering the pH range of 4 to 7.

CONTROLS:

Calibration: LTBL plus 2 standards, eg, QCA  
Drift : 2 standard buffers -4 times daily.

## ACIDITY - TOTAL FIXED ENDPOINT

QUALITY CONTROL DATA FROM 17/08/82 TO 21/12/82

LAB: Dorset

Analytical Range: 0.70 to 50.00 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	72	25.00	24.92	-0.08	0.441
B :	72	10.00	10.23	0.23	0.366
A+B :	72	35.00	35.14	0.14	0.633
A-B :	72	15.00	14.69	-0.31	0.507

s.d(AB): Sw(within run): 0.358

S(between runs): 0.405

S/Sw: 1.13

On any given day the calibration is accepted if the values obtained lie within the ranges:

33.43 to 36.58 for A+B  
13.95 to 16.05 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
3	0.00 - 2.00	0.429	42.91
122	2.00 - 10.00	0.809	13.49
38	10.00 - 25.00	0.646	3.69
4	25.00 - 50.00	0.271	0.72
167	Overall	0.761	N/A

DETECTION CRITERION: 0.70

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	67	0.47	0.161

## ACIDITY - TOTAL FIXED ENDPOINT

QUALITY CONTROL DATA FROM 11/01/83 TO 21/12/83

LAB: Dorset

Analytical Range: 0.15 to 50.00 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	163	25.00	25.02	0.02	0.327
B :	162	10.00	10.32	0.32	0.274
A+B :	161	35.00	35.33	0.33	0.452
A-B :	161	15.00	14.70	-0.30	0.397

s.d(AB): Sw(within run): 0.281

S(between runs): 0.302

S/Sw: 1.08

On any given day the calibration is accepted if the values obtained lie within the ranges:

33.43 to 36.58 for A+B

13.95 to 16.05 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
10	0.00 - 2.00	0.091	9.10
289	2.00 - 10.00	0.786	13.10
104	10.00 - 25.00	1.676	9.57
22	25.00 - 50.00	1.736	4.63
425	Overall	1.176	N/A

DETECTION CRITERION: 0.15

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	160	0.44	0.799



# ACIDITY - TOTAL FIXED ENDPOINT

QUALITY CONTROL DATA FROM 05/01/84 TO 20/12/84

LAB: Dorset

Analytical Range: 0.23 to 50.00 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	145	25.00	25.10	0.10	0.271
B :	144	10.00	10.18	0.18	0.208
A+B :	143	35.00	35.27	0.27	0.307
A-B :	143	15.00	14.92	-0.08	0.375

s.d(AB): Sw(within run): 0.265      S(between runs): 0.242      S/Sw: 0.91

On any given day the calibration is accepted if the values obtained lie within the ranges:

33.43 to 36.58 for A+B  
13.95 to 16.05 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
12	0.00 - 2.00	0.140	14.00
239	2.00 - 10.00	0.683	11.39
110	10.00 - 25.00	1.083	6.19
39	25.00 - 50.00	1.722	4.59
400	Overall	0.966	N/A

DETECTION CRITERION: 0.23

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	139	0.09	0.183

\*\*\* ACIDITY - TOTAL FIXED ENDPOINT (TFE) \*\*\*

IDENTIFICATION:

Laboratory	: Precipitation	Method Introduced:	01/05/79
LIS Test Name Code:	ACDT	Units	: mg/L as CaCO <sub>3</sub>
Work Station Code	: PHACD	Unit Code	: 064915
Method Code	: 001BT2	Supervisor	: M. Rawlings
Sample Type/Matrix : Precipitation, Throughfall, Stemflow, Domestic Waters, Industrial Wastes, Sewage, Rivers, Lakes			

SAMPLING:

Quantity Required: 15 mL  
Container : Polystyrene

ANALYTICAL PROCEDURE:

Sample aliquots (10.0 mL) are titrated in an automated system with 0.01N sodium hydroxide to a pH endpoint of 8.3. The titrant is standardized by titrating 0.005N potassium hydrogen phthalate to the pH endpoint of 8.3. The titrant delivery rate is determined from the slope of the titration curve and the stability of the pH readings following each aliquot of titrant.  
N.B. pH and Gran acidity are determined simultaneously

INSTRUMENTATION:

Automated modular titration system with microcomputer control and data reduction software.

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.01                      Detection Criterion (T): 0.2

CALIBRATION:

2 standard buffers covering the pH range of 4 to 7.

CONTROLS:

Calibration : LTBL plus two standards, eg, QCA

MODIFICATIONS:

01/04/82- Sample volume was decreased from 100.0 to 10.0 mL.  
01/05/83- System was fully automated by introduction of a sampler, and an automated device for washing the electrode between analyses.

NOTES:

Due to the instability of the QC standards at these concentration levels, calibration control limits are based on measured averages rather than theoretical concentrations.

# ACIDITY - TOTAL FIXED ENDPOINT

QUALITY CONTROL DATA FROM 01/01/82 TO 16/12/82

LAB: Precipitation

Analytical Range: 0.20 to 100.0 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	180	25.00	24.90	-0.10	0.491
B :	180	10.00	10.70	0.70	0.347
A+B :	179	35.00	35.59	0.59	0.745
A-B :	179	15.00	14.20	-0.80	0.413

s.d(AB): Sw(within run): 0.292      S(between runs): 0.425      S/Sw: 1.45

On any given day the calibration is accepted if the values obtained lie within the ranges:

33.79 to 37.39 for A+B  
13.00 to 15.40 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
41	0.00 - 2.00	0.122	12.21
43	2.00 - 5.00	0.224	6.40
25	5.00 - 10.00	0.175	2.33
6	10.00 - 25.0	0.58	3.29
13	25.0 - 100.0	0.99	1.58
128	Overall	0.45	N/A

DETECTION CRITERION: 0.20

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	121	0.82	0.212

## ACIDITY - TOTAL FIXED ENDPOINT

QUALITY CONTROL DATA FROM 05/01/83 TO 22/12/83

LAB: Precipitation

Analytical Range: 0.21 to 100.0 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	145	25.00	25.12	0.12	0.675
B :	145	10.00	10.41	0.41	0.368
A+B :	144	35.00	35.53	0.53	0.889
A-B :	144	15.00	14.72	-0.28	0.612

s.d(AB): Sw(within run): 0.433

S(between runs): 0.543

S/Sw: 1.26

On any given day the calibration is accepted if the values obtained lie within the ranges:

33.73 to 37.33 for A+B  
13.51 to 15.91 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
5	0.00 - 2.00	0.130	12.95
12	2.00 - 5.00	0.187	5.33
8	5.00 - 10.00	0.136	1.82
2	10.00 - 25.0	0.21	1.21
1	25.0 - 100.0	N/A	N/A
28	Overall	0.15	N/A

DETECTION CRITERION: 0.21

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	73	0.87	0.180

# ACIDITY - TOTAL FIXED ENDPOINT

QUALITY CONTROL DATA FROM 03/01/84 TO 21/12/84

LAB: Precipitation

Analytical Range: 0.18 to 100.0 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	158	25.00	24.98	-0.02	0.393
B :	158	10.00	10.15	0.15	0.364
A+B :	157	35.00	35.13	0.13	0.714
A-B :	157	15.00	14.83	-0.17	0.255

s.d(AB): Sw(within run): 0.180

S(between runs): 0.379

S/Sw: 2.10

On any given day the calibration is accepted if the values obtained lie within the ranges:

33.33 to 36.93 for A+B  
13.64 to 16.04 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
45	0.00 - 2.00	0.110	10.97
93	2.00 - 5.00	0.113	3.22
33	5.00 - 10.00	0.114	1.53
9	10.00 - 25.0	1.25	7.12
3	25.0 - 100.0	0.17	0.28
183	Overall	0.35	N/A

DETECTION CRITERION: 0.18

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	155	0.82	0.240

\*\*\* ALKALINITY - GRAN \*\*\*

IDENTIFICATION:

Laboratory : Dorset Method Introduced: 26/07/79  
Supervisor : F. Tomassini Units : mg/L as CaCO<sub>3</sub>  
Sample Type/Matrix: Streams, Precipitation, Groundwaters

SAMPLING:

Quantity Required: 150 mL  
Container : Polyethylene bottle filled to the brim; screw caps with cone-shaped liners are preferred.

ANALYTICAL PROCEDURE:

Samples (100 mL) are weighed (volume = weight), and titrated with 0.02 N sulphuric acid to a pH < 4.0. The titrant delivery rate is determined from the slope of the titration curve and the stability of the pH reading following each aliquot of titrant. Data are subjected to Gran analysis.  
N.B. pH is determined simultaneously.

INSTRUMENTATION:

Semi-automated modular titration system with microcomputer control and data reduction software.

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.01 Detection Criterion (T): 0.3

CALIBRATION:

2 standard buffers covering the pH range of 4 to 7.

CONTROLS:

Calibration: LTBL plus 3 standards, eg, QCA.  
Drift : 2 standard buffers -4 times daily.

# ALKALINITY - GRAN

QUALITY CONTROL DATA FROM 05/01/82 TO 17/12/82

LAB: Dorset

Analytical Range: 0.10 to 100.0 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	189	20.00	19.93	-0.07	0.175
B :	189	5.00	4.83	-0.17	0.090
A+B :	188	25.00	24.76	-0.24	0.192
A-B :	188	15.00	15.09	0.09	0.198

s.d(AB): Sw(within run): 0.140      S(between runs): 0.139      S/Sw: 0.99

On any given day the calibration is accepted if the values obtained lie within the ranges:

24.10 to 25.90 for A+B  
14.40 to 15.60 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
210	0.00 - 2.00	0.058	5.81
250	2.00 - 10.00	0.053	0.88
8	10.00 - 25.00	0.052	0.30
2	25.00 - 50.0	0.00	0.00
1	50.0 - 100.0	N/A	N/A
471	Overall	0.06	N/A

DETECTION CRITERION: 0.10

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	180	-0.13	0.095
QCX :	55	9.96	0.089

# ALKALINITY - GRAN

QUALITY CONTROL DATA FROM 07/01/83 TO 22/12/83

LAB: Dorset

Analytical Range: 0.26 to 100.0 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	184	20.00	20.02	0.02	0.201
B :	184	5.00	4.89	-0.11	0.077
A+B :	183	25.00	24.91	-0.09	0.238
A-B :	183	15.00	15.13	0.13	0.188

s.d(AB): Sw(within run): 0.133

S(between runs): 0.152

S/Sw: 1.14

On any given day the calibration is accepted if the values obtained lie within the ranges:

24.10 to 25.90 for A+B  
14.40 to 15.60 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
205	0.00 - 2.00	0.159	15.94
225	2.00 - 10.00	0.293	4.88
14	10.00 - 25.00	0.285	1.63
10	25.00 - 50.0	0.17	0.46
2	50.0 - 100.0	0.10	0.13
456	Overall	0.24	N/A

DETECTION CRITERION: 0.26

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	182	-0.09	0.157
QCX :	59	8.81	3.022



# ALKALINITY - GRAN

QUALITY CONTROL DATA FROM 05/01/84 TO 21/12/84

LAB: Dorset

Analytical Range: 0.14 to 100.0 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	191	20.00	20.18	0.18	0.281
B :	191	5.00	4.92	-0.08	0.091
A+B :	190	25.00	25.10	0.10	0.346
A-B :	190	15.00	15.26	0.26	0.234

s.d(AB): Sw(within run): 0.165      S(between runs): 0.209      S/Sw: 1.27

On any given day the calibration is accepted if the values obtained lie within the ranges:

24.10 to 25.90 for A+B  
14.40 to 15.60 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
153	0.00 - 2.00	0.084	8.42
156	2.00 - 10.00	0.092	1.53
12	10.00 - 25.00	0.052	0.30
1	25.00 - 50.0	N/A	N/A
1	50.0 - 100.0	N/A	N/A
323	Overall	0.09	N/A

DETECTION CRITERION: 0.14

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	196	-0.07	0.881

\*\*\* ALKALINITY - GRAN \*\*\*

IDENTIFICATION:

Laboratory	: Rivers and Lakes	Method Introduced:	09/07/80
LIS Test Name Code:	ALKTI	Units	: mg/L as CaCO <sub>3</sub>
Work Station Code	: RMGALK	Unit Code	: 064915
Method Code	: 004AT6	Supervisor	: J. Crowther
Sample Type/Matrix:	Rivers, Lakes, Precipitation, Soil Extracts, Effluents		

SAMPLING:

Quantity Required: 150 mL  
Container : Polyethylene bottle filled to the brim; screw caps with cone-shaped liners are preferred.

ANALYTICAL PROCEDURE:

Samples (100 mL) are weighed (volume = weight), and titrated with 0.02 N sulphuric acid to pH <4.0. The titrant delivery rate is determined from the slope of the titration curve and the stability of the pH reading following each aliquot of titrant. Data are subjected to Gran analysis.  
N.B. pH and total fixed endpoint alkalinity are determined simultaneously.

INSTRUMENTATION:

Semi-automated modular titration system with microcomputer control and data reduction software.

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.01                      Detection Criterion (T): 0.05

CALIBRATION:

2 standard buffers covering the pH range 4 to 7.

CONTROLS:

Calibration: LTBL plus two standards, eg, QCA.  
Drift : 2 standard buffers -4 times daily.

MODIFICATIONS:

02/03/84 -QC program was expanded to include pH and total fixed endpoint alkalinity; preparation and storage of QC solutions was modified.

16/03/84 -Use of 4 oz. polyethylene bottles plus screw caps with cone-shaped liners was recommended for sampling.

# ALKALINITY - GRAN

QUALITY CONTROL DATA FROM 04/01/82 TO 23/12/82

LAB: Rivers and Lakes

Analytical Range: 0.03 to 25.0 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	162	10.00	9.99	-0.01	0.249
B :	161	2.50	2.39	-0.11	0.076
A+B :	159	12.50	12.38	-0.12	0.293
A-B :	159	7.50	7.60	0.10	0.225

s.d(AB): Sw(within run): 0.159      S(between runs): 0.184      S/Sw: 1.16

On any given day the calibration is accepted if the values obtained lie within the ranges:

11.38 to 13.63 for A+B  
6.75 to 8.25 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
44	-2.00 - 0.00	0.019	-1.93
21	0.00 - 2.00	0.026	2.65
14	2.00 - 5.00	0.027	0.78
16	5.00 - 10.0	0.05	0.71
4	10.0 - 25.0	0.08	0.45
99	Overall	0.04	N/A

DETECTION CRITERION: 0.03

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	154	-0.10	0.073
Slope :	127	97.4	8.77

# ALKALINITY - GRAN

QUALITY CONTROL DATA FROM 04/01/83 TO 23/12/83

LAB: Rivers and Lakes

Analytical Range: 0.17 to 25.0 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	165	10.00	9.94	-0.06	0.127
B :	165	2.50	2.40	-0.10	0.077
A+B :	163	12.50	12.34	-0.16	0.178
A-B :	163	7.50	7.55	0.05	0.111

s.d(AB): Sw(within run): 0.078

S(between runs): 0.105

S/Sw: 1.35

On any given day the calibration is accepted if the values obtained lie within the ranges:

11.38 to 13.63 for A+B  
6.75 to 8.25 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
22	-2.00 - 0.00	0.101	-10.11
46	0.00 - 2.00	0.194	19.42
18	2.00 - 5.00	0.118	3.38
14	5.00 - 10.0	0.07	0.99
14	10.0 - 25.0	0.11	0.63
114	Overall	0.15	N/A

DETECTION CRITERION: 0.17

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	158	-0.07	0.133

# ALKALINITY - GRAN

QUALITY CONTROL DATA FROM 01/01/84 TO 27/11/84

LAB: Rivers and Lakes

Analytical Range: 0.03 to 25.0 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	110	10.00	9.88	-0.12	0.098
B :	109	2.50	2.34	-0.16	0.068
A+B :	108	12.50	12.23	-0.27	0.126
A-B :	108	7.50	7.54	0.04	0.109

s.d(AB): Sw(within run): 0.077      S(between runs): 0.084      S/Sw: 1.09

On any given day the calibration is accepted if the values obtained lie within the ranges:

11.38 to 13.63 for A+B  
6.75 to 8.25 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
6	-2.00 - 0.00	0.019	-1.94
17	0.00 - 2.00	0.062	6.19
18	2.00 - 5.00	0.049	1.39
28	5.00 - 10.0	0.04	0.50
13	10.0 - 25.0	0.08	0.47
82	Overall	0.06	N/A

DETECTION CRITERION: 0.03

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	109	-0.08	0.063

\*\*\* ALKALINITY-TOTAL FIXED ENDPOINT (TFE) \*\*\*

IDENTIFICATION:

Laboratory	: Domestic Water	Method Introduced:	01/06/65
LIS Test Name Code:	ALKT	Units	: mg/L as CaCO <sub>3</sub>
Work Station Code	: WALK	Unit Code	: 064915
Method Code	: 003CT3	Supervisor	: M. Rawlings
Sample Type/Matrix:	Domestic Waters, Leachates, Sewage, Industrial Waste, Effluents		

SAMPLING:

Quantity Required: 75 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

Samples (50.0 mL) are manually pipetted and titrated automatically with 0.02 N sulphuric acid to a pH endpoint of 4.5. Sludges are centrifuged before analysis.

INSTRUMENTATION:

- Automated Fisher Titralyzer II system.

REPORTING:

Maximum Significant Figures:	4	
Minimum Increment (W) :	0.2	Detection Criterion (T): 1

CALIBRATION:

BL plus 2 standards

CONTROLS:

Calibration: 2 standards, eg, QCA  
Drift : 1 standard

# ALKALINITY - TOTAL FIXED ENDPOINT

QUALITY CONTROL DATA FROM 04/01/82 TO 23/12/82

LAB: Domestic Water

Analytical Range: 1 to 1000 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	169	285	284	-1	3.2
B :	168	57	60	3	1.9
A+B :	167	342	344	2	4.5
A-B :	167	228	224	-4	2.8

s.d(AB): Sw(within run): 2.0

S(between runs): 2.6

S/Sw: 1.32

On any given day the calibration is accepted if the values obtained lie within the ranges:

330 to 354 for A+B  
220 to 236 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
79	0 - 50	0.6	2.54
81	50 - 100	1.4	1.86
109	100 - 200	1.2	0.77
173	200 - 500	7.5	2.13
5	500 - 1000	16.7	2.22
447	Overall	5.1	N/A

DETECTION CRITERION: 1

# ALKALINITY - TOTAL FIXED ENDPOINT

QUALITY CONTROL DATA FROM 04/01/83 TO 30/12/83

LAB: Domestic Water

Analytical Range: 1 to 1000 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	175	285	286	1	3.8
B :	174	57	61	4	4.5
A+B :	171	342	347	5	6.9
A-B :	171	228	225	-3	4.7

s.d(AB): Sw(within run): 3.3

S(between runs): 4.2

S/Sw: 1.27

On any given day the calibration is accepted if the values obtained lie within the ranges:

330 to 354 for A+B  
220 to 236 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
62	0 - 50	0.8	3.12
57	50 - 100	2.2	2.96
77	100 - 200	3.3	2.20
125	200 - 500	1.9	0.55
3	500 - 1000	3.4	0.46
324	Overall	2.3	N/A

DETECTION CRITERION: 1



# ALKALINITY - TOTAL FIXED ENDPOINT

QUALITY CONTROL DATA FROM 17/01/84 TO 27/12/84

LAB: Domestic Water

Analytical Range: 1 to 1000 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	178	285	286	1	2.5
B :	178	57	60	3	1.3
A+B :	177	342	345	3	3.5
A-B :	177	228	226	-2	1.9

s.d(AB): Sw(within run): 1.3

S(between runs): 2.0

S/Sw: 1.50

On any given day the calibration is accepted if the values obtained lie within the ranges:

330 to 354 for A+B  
220 to 236 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
91	0 - 50	0.6	2.42
102	50 - 100	1.2	1.58
112	100 - 200	4.3	2.89
191	200 - 500	7.7	2.20
6	500 - 1000	9.4	1.25
502	Overall	5.4	N/A

DETECTION CRITERION: 1

\*\*\* ALKALINITY - TOTAL FIXED ENDPOINT (TFE) \*\*\*

IDENTIFICATION:

Laboratory	: Rivers and Lakes	Method Introduced:	09/07/80
LIS Test Name Code:	ALKT	Units	: mg/L as CaCO <sub>3</sub>
Work Station Code	: RMGALK	Unit Code	: 064915
Method Code	: 004AT6	Supervisor	: J. Crowther
Sample Type/Matrix:	Rivers, Lakes, Precipitation		

SAMPLING:

Quantity Required: 150 mL  
Container : Polyethylene bottle filled to the brim; screw caps with cone-shaped liners are preferred.

ANALYTICAL PROCEDURE:

Samples (100 mL) are weighed (volume = weight), and titrated with 0.02 N sulphuric acid to a pH endpoint of 4.5. The titrant delivery rate is determined from the slope of the titration curve and the stability of the pH reading following each aliquot of titrant.

N.B. pH and Gran alkalinity are determined simultaneously.

INSTRUMENTATION:

Semi-automated modular titration system with microcomputer control and data reduction software.

REPORTING:

Maximum Significant Figures: 4  
Minimum Increment (W) : 0.01                      Detection Criterion (T): 0.14

CALIBRATION:

2 standard buffers covering the pH range 4 to 7.

CONTROLS:

Calibration: LTBL plus two standards, eg, QCA.  
Drift : 2 standard buffers -4 times daily.

MODIFICATIONS:

02/03/84- QC program was expanded to include pH and total fixed endpoint alkalinity; preparation and storage of QC solutions was modified.

16/03/84- Use of 4 oz. polyethylene bottles plus screw caps with cone-shaped liners was recommended for sampling.

NOTES:

The ranges for accepting calibration controls are based on measured averages. The data for the long term blank shows that there is a significant alkalinity for the distilled water matrix, and the alkalinity values for the calibration controls exceed the "expected" concentrations (due to sodium carbonate) by the alkalinity for the matrix. An adjustment for this matrix effect is not applied because total fixed endpoint alkalinity is defined as the alkalinity associated with a titration to pH 4.5.

# ALKALINITY - TOTAL FIXED ENDPOINT

QUALITY CONTROL DATA FROM 02/03/84 TO 27/11/84

LAB: Rivers and Lakes

Analytical Range: 0.14 to 25.00 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	81	10.00	11.83	1.83	0.200
B :	80	2.50	4.20	1.70	0.202
A+B :	80	12.50	16.03	3.53	0.373
A-B :	80	7.50	7.63	0.13	0.152

s.d(AB): Sw(within run): 0.107      S(between runs): 0.201      S/Sw: 1.87

On any given day the calibration is accepted if the values obtained lie within the ranges:

15.13 to 16.93 for A+B  
7.03 to 8.23 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
1	0.00 - 2.00	N/A	N/A
17	2.00 - 5.00	0.084	2.39
17	5.00 - 10.00	0.212	2.83
9	10.00 - 25.00	0.214	1.22
44	Overall	0.172	N/A

DETECTION CRITERION: 0.14

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	80	1.67	0.150

\*\*\* ALKALINITY-TOTAL FIXED ENDPOINT (TFE) \*\*\*

IDENTIFICATION:

Laboratory	: Rivers and Lakes	Method Introduced:	01/04/74
LIS Test Name Code:	ALKT	Units	: mg/L as CaCO <sub>3</sub>
Work Station Code	: RMALK	Unit Code	: 064915
Method Code	: 003BT3	Supervisor	: J. Crowther
Sample Type/Matrix:	Rivers, Lakes, Effluents		

SAMPLING:

Quantity Required: 25 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

Samples (10.0 mL) are automatically pipetted by the instrument and titrated with 0.020 N sulphuric acid to a pH endpoint of 4.5.

INSTRUMENTATION:

- Automated Radiometer ATS-1 titration system.

REPORTING:

Maximum Significant Figures:	3	
Minimum Increment (W) :	0.1	Detection Criterion (T): 1.9

CALIBRATION:

2 buffers covering the pH range 4 to 7; BL plus 3 standards

CONTROLS:

Calibration : LTBL plus 2 standards, eg, QCA  
Drift : 2 standards

# ALKALINITY - TOTAL FIXED ENDPOINT

QUALITY CONTROL DATA FROM 12/01/82 TO 23/12/82

LAB: Rivers and Lakes

Analytical Range: 1.9 to 500 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	141	89.0	89.5	0.5	0.69
B :	141	44.5	45.2	0.7	0.48
A+B :	140	133.5	134.7	1.2	1.04
A-B :	140	44.5	44.4	-0.1	0.57

s.d(AB): Sw(within run): 0.40

S(between runs): 0.59

S/Sw: 1.46

On any given day the calibration is accepted if the values obtained lie within the ranges:

129.0 to 138.0 for A+B  
41.5 to 47.5 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
72	0.0 - 20.0	1.17	11.72
39	20.0 - 50.0	1.03	2.95
75	50.0 - 100.0	0.68	0.90
63	100.0 - 200	1.4	0.91
62	200 - 500	1.9	0.54
311	Overall	1.3	N/A

DETECTION CRITERION: 1.9

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	125	2.2	0.86

# ALKALINITY - TOTAL FIXED ENDPOINT

QUALITY CONTROL DATA FROM 04/01/83 TO 21/12/83

LAB: Rivers and Lakes

Analytical Range: 3.1 to 500 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	167	89.0	89.1	0.1	0.73
B :	167	44.5	44.5	-0.0	0.53
A+B :	166	133.5	133.5	0.0	1.14
A-B :	166	44.5	44.6	0.1	0.57

s.d(AB): Sw(within run): 0.40

S(between runs): 0.64

S/Sw: 1.58

On any given day the calibration is accepted if the values obtained lie within the ranges:

129.0 to 138.0 for A+B

41.5 to 47.5 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
115	0.0 - 20.0	1.90	18.96
57	20.0 - 50.0	1.06	3.02
86	50.0 - 100.0	1.46	1.94
140	100.0 - 200	1.6	1.10
120	200 - 500	1.7	0.49
518	Overall	1.7	N/A

DETECTION CRITERION: 3.1

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	166	2.7	0.85

# ALKALINITY - TOTAL FIXED ENDPOINT

QUALITY CONTROL DATA FROM 03/01/84 TO 19/11/84

LAB: Rivers and Lakes

Analytical Range: 1.5 to 500 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	86	89.0	88.8	-0.2	1.19
B :	86	44.5	44.9	0.4	0.62
A+B :	86	133.5	133.7	0.2	1.64
A-B :	86	44.5	43.9	-0.6	0.96

s.d(AB): Sw(within run): 0.68

S(between runs): 0.95

S/Sw: 1.40

On any given day the calibration is accepted if the values obtained lie within the ranges:

129.0 to 138.0 for A+B  
41.5 to 47.5 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
49	0.0 - 20.0	0.94	9.45
33	20.0 - 50.0	0.86	2.47
37	50.0 - 100.0	1.58	2.11
81	100.0 - 200	2.6	1.75
52	200 - 500	4.0	1.16
252	Overall	2.5	N/A

DETECTION CRITERION: 1.5

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	84	4.2	3.84

\*\*\* CALCIUM \*\*\*

IDENTIFICATION:

Laboratory	: Domestic Water	Method Introduced:	01/06/82
LIS Test Name Code:	CAUR	Units	: mg/L as Ca
Work Station Code	: WCAMGH	Unit Code	: 064820
Method Code	: 002AA1	Supervisor	: M.Rawlings
Sample Type/Matrix: Domestic Waters, Leachates, Effluents			

SAMPLING:

Quantity Required: 100 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

Samples are analyzed by AAS at 422.7 nm using an air-acetylene flame. Acidified lanthanum chloride is added as a releasing agent via an automated sampling train.

Approximate absorbance: 0.16 at the 50 mg/L as Ca level.

INSTRUMENTATION:

Automated modular continuous flow atomic absorption system(AAS). Two analytical ranges are obtained from the output of the AAS.

REPORTING:

Maximum Significant Figures: 3	
Minimum Increment (W) : 0.1	Detection Criterion (T): 0.5

CALIBRATION:

BL plus 2 standards

CONTROLS:

Calibration : LTBL plus 3 standards, eg, QCA  
Drift : BL plus 3 standards

MODIFICATIONS:

01/07/82- The method introduced on this date differed slightly from Method B for calcium in HAMES in that full scale for the analytical range was 50.0 mg/L; concentrations for the QC standards were also adjusted.



# CALCIUM

QUALITY CONTROL DATA FROM 06/07/82 TO 23/12/82

LAB: Domestic Water

Analytical Range: 1.5 to 200 mg/L as Ca

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	52	133	130	-2	2.2
B :	52	33	33	0	1.0
A+B :	52	165	163	-2	2.4
A-B :	52	100	98	-2	2.4
C :	52	32.5	32.9	0.4	0.84
D :	52	6.5	6.6	0.1	0.30
C+D :	52	39.0	39.5	0.5	0.99
C-D :	52	26.0	26.2	0.2	0.78

s.d(AB): Sw(within run): 1.7

S(between runs): 1.7

S/Sw: 0.99

s.d(CD): Sw(within run): 0.55

S(between runs): 0.63

S/Sw: 1.15

On any given day the calibration is accepted if the values obtained lie within the ranges:

156 to 174 for A+B  
94 to 106 for A-B  
36.8 to 41.3 for C+D  
24.5 to 27.5 for C-D

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
19	0.0 - 10.0	0.90	18.01
15	10.0 - 25.0	1.33	7.59
17	25.0 - 50.0	1.10	2.92
51	50.0 - 100	1.9	2.49
29	100 - 200	4.1	2.71
131	Overall	2.5	N/A

DETECTION CRITERION: 1.5

# CALCIUM

QUALITY CONTROL DATA FROM 05/01/83 TO 20/12/83

LAB: Domestic Water

Analytical Range: 0.9 to 200 mg/L as Ca

## CALIBRATION CONTROL:

	Number of Data	Expected Concn	Av. Concn Measured	Av. Bias	Standard Deviation
A :	109	133	130	-2	2.4
B :	109	33	32	-0	1.0
A+B :	108	165	163	-2	2.6
A-B :	108	100	98	-2	2.5
C :	109	32.5	32.8	0.3	0.73
D :	109	6.5	6.4	-0.1	0.33
C+D :	108	39.0	39.2	0.2	0.88
C-D :	108	26.0	26.4	0.4	0.72

s.d(AB): Sw(within run): 1.8

S(between runs): 1.8

S/Sw: 1.02

s.d(CD): Sw(within run): 0.51

S(between runs): 0.57

S/Sw: 1.11

On any given day the calibration is accepted if the values obtained lie within the ranges:

156 to 174 for A+B  
94 to 106 for A-B  
36.8 to 41.3 for C+D  
24.5 to 27.5 for C-D

## DUPLICATES:

Number of Data Pairs	Sample Concn Span	Mean s.d.	Relative s.d. (%)
44	0.0 - 10.0	0.53	10.67
33	10.0 - 25.0	0.67	3.84
82	25.0 - 50.0	1.44	3.83
89	50.0 - 100	2.9	3.93
46	100 - 200	2.5	1.65
294	Overall	2.2	N/A

DETECTION CRITERION: 0.9

# CALCIUM

QUALITY CONTROL DATA FROM 06/01/84 TO 07/12/84

LAB: Domestic Water

Analytical Range: 0.5 to 200 mg/L as Ca

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	109	133	129	-3	1.4
B :	109	33	32	-0	0.6
A+B :	108	165	162	-3	1.5
A-B :	108	100	97	-3	1.5
C :	109	32.5	32.5	0.0	0.51
D :	109	6.5	6.4	-0.1	0.20
C+D :	108	39.0	39.0	-0.0	0.56
C-D :	108	26.0	26.1	0.1	0.53

s.d(AB): Sw(within run): 1.0

S(between runs): 1.1

S/Sw: 1.01

s.d(CD): Sw(within run): 0.38

S(between runs): 0.38

S/Sw: 1.02

On any given day the calibration is accepted if the values obtained lie within the ranges:

156 to 174 for A+B  
94 to 106 for A-B  
36.8 to 41.3 for C+D  
24.5 to 27.5 for C-D

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
24	0.0 - 10.0	0.28	5.66
33	10.0 - 25.0	0.36	2.03
81	25.0 - 50.0	0.56	1.50
108	50.0 - 100	0.7	0.97
61	100 - 200	1.2	0.79
307	Overall	0.8	N/A

DETECTION CRITERION: 0.5

\*\*\* CALCIUM \*\*\*

IDENTIFICATION:

Laboratory	: Precipitation	Method Introduced:	18/05/79
LIS Test Name Code:	CAUR	Units	: mg/L as Ca
Work Station Code	: PRAA	Unit Code	: 064820
Method Code	: 002CA1	Supervisor	: M. Rawlings
Sample Type/Matrix: Precipitation, Throughfall, Stemflow.			

SAMPLING:

Quantity Required: 25 mL  
Container : Polystyrene

ANALYTICAL PROCEDURE:

Samples are analysed by AAS at 422.7 nm with an air-acetylene flame. Acidified lanthanum chloride is added as a releasing agent via an automated sampling train.  
Approximate absorbance: 0.2 at the 2.00 mg/L level.

INSTRUMENTATION:

Automated modular continuous flow atomic absorption spectrophotometer (AAS) system

REPORTING:

Maximum Significant Figures: 3	
Minimum Increment (W) : 0.01	Detection Criterion (T): 0.04

CALIBRATION:

BL plus 6 standards

CONTROLS:

Calibration : 2 standards, eg, QCA  
Drift : BL plus 2 standards every 10 samples

# CALCIUM

QUALITY CONTROL DATA FROM 01/01/82 TO 22/12/82

LAB: Precipitation

Analytical Range: 0.04 to 2.00 mg/L as Ca

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	91	1.20	1.21	0.01	0.024
B :	91	0.20	0.20	-0.00	0.020
A+B :	90	1.40	1.41	0.01	0.034
A-B :	90	1.00	1.01	0.01	0.029

s.d(AB): Sw(within run): 0.021      S(between runs): 0.022      S/Sw: 1.07

On any given day the calibration is accepted if the values obtained lie within the ranges:

1.31 to 1.49 for A+B  
0.94 to 1.06 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
62	0.00 - 0.40	0.023	11.75
16	0.40 - 1.00	0.035	4.98
11	1.00 - 2.00	0.029	1.94
89	Overall	0.027	N/A

DETECTION CRITERION: 0.04

# CALCIUM

QUALITY CONTROL DATA FROM 06/01/83 TO 21/12/83

LAB: Precipitation

Analytical Range: 0.02 to 2.00 mg/L as Ca

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	46	1.20	1.23	0.03	0.034
B :	46	0.20	0.21	0.01	0.015
A+B :	46	1.40	1.44	0.04	0.038
A-B :	46	1.00	1.03	0.03	0.036

s.d(AB): Sw(within run): 0.026

S(between runs): 0.026

S/Sw: 1.02

On any given day the calibration is accepted if the values obtained lie within the ranges:

1.31 to 1.49 for A+B  
0.94 to 1.06 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
11	0.00 - 0.40	0.013	6.50
3	0.40 - 1.00	0.046	6.55
2	1.00 - 2.00	0.007	0.47
16	Overall	0.026	N/A

DETECTION CRITERION: 0.02

# CALCIUM

QUALITY CONTROL DATA FROM 03/01/84 TO 05/12/84

LAB: Precipitation

Analytical Range: 0.02 to 2.00 mg/L as Ca

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	53	1.20	1.22	0.02	0.022
B :	53	0.20	0.20	-0.00	0.014
A+B :	53	1.40	1.42	0.02	0.027
A-B :	53	1.00	1.03	0.03	0.025

s.d(AB): Sw(within run): 0.018      S(between runs): 0.018      S/Sw: 1.04

On any given day the calibration is accepted if the values obtained lie within the ranges:

1.31 to 1.49 for A+B  
0.94 to 1.06 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
67	0.00 - 0.40	0.011	5.39
12	0.40 - 1.00	0.028	3.97
13	1.00 - 2.00	0.021	1.38
92	Overall	0.017	N/A

DETECTION CRITERION: 0.02

\*\*\* CALCIUM \*\*\*

IDENTIFICATION:

Laboratory	: Rivers and Lakes	Method Introduced:	01/04/74
LIS Test Name Code:	CAUR	Units	: mg/L as Ca
Work Station Code	: RMCAMGH,RMCAMGL	Unit Code	: 064820
Method Code	: 002AA1,002BA1	Supervisor	: J. Crowther
Sample Type/Matrix:	Rivers, Lakes, Soil Extracts, Effluents.		

SAMPLING:

Quantity Required: 50 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

Samples are analyzed by AAS at 422.7 nm using an air-acetylene flame. Acidified lanthanum chloride is added as a releasing agent via an automated sampling train.

Approximate absorbance: RMCAMGH: 0.9, RMCAMGL: 0.5; full scale values

INSTRUMENTATION:

Automated modular continuous flow atomic absorption system(AAS).

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.2, 0.01      Detection Criterion (T):0.3, 0.02

CALIBRATION:

BL plus 10 standards

CONTROLS:

Calibration : LTBL plus 2 standards, eg, QCA for each analytical range  
Drift : BL plus 1 standard for each analytical range

MODIFICATIONS:

01/12/81- Calibration range became 20.0 mg/L full scale; second analytical range was dropped.

01/03/84- Analytical range(RMCAMGL) was added; full scale:5.00 mg/L. This range is currently restricted to special programs.

01/09/84- Analytical range(RMCAMGH) was increased from 20.0 to 50.0 mg/L full scale. Calibration technique was changed from quadratric to linear interpolation. Magnesium is no longer determined simultaneously.



# CALCIUM

QUALITY CONTROL DATA FROM 07/01/82 TO 23/12/82

LAB: Rivers and Lakes

Analytical Range: 0.5 to 20.0 mg/L as Ca

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	69	15.00	15.02	0.02	0.165
B :	69	6.00	6.08	0.08	0.106
A+B :	69	21.00	21.11	0.11	0.229
A-B :	69	9.00	8.94	-0.06	0.156

s.d(AB): Sw(within run): 0.110      S(between runs): 0.138      S/Sw: 1.26

On any given day the calibration is accepted if the values obtained lie within the ranges:

20.10 to 21.90 for A+B  
8.40 to 9.60 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
146	0.0 - 4.0	0.28	14.12
26	4.0 - 10.0	0.25	3.57
16	10.0 - 20.0	0.22	1.47
188	Overall	0.28	N/A

DETECTION CRITERION: 0.5

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	38	0.00	0.000
Full Scale Abs :	65	0.969	0.1083

# CALCIUM

QUALITY CONTROL DATA FROM 05/01/83 TO 22/12/83

LAB: Rivers and Lakes

Analytical Range: 0.3 to 20.0 mg/L as Ca

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	67	15.00	15.18	0.18	0.251
B :	67	6.00	6.10	0.10	0.136
A+B :	67	21.00	21.29	0.29	0.308
A-B :	67	9.00	9.08	0.08	0.260

s.d(AB): Sw(within run): 0.184      S(between runs): 0.202      S/Sw: 1.10

On any given day the calibration is accepted if the values obtained lie within the ranges:

20.10 to 21.90 for A+B  
8.40 to 9.60 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
152	0.0 - 4.0	0.17	8.29
39	4.0 - 10.0	0.44	6.29
14	10.0 - 20.0	0.52	3.50
205	Overall	0.30	N/A

DETECTION CRITERION: 0.3

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	67	0.00	0.000
Full Scale Abs :	65	0.822	0.1478

# CALCIUM

QUALITY CONTROL DATA FROM 06/01/84 TO 29/08/84

LAB: Rivers and Lakes

Analytical Range: 0.3 to 20.0 mg/L as Ca

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	43	15.00	14.95	-0.05	0.161
B :	43	6.00	6.01	0.01	0.097
A+B :	43	21.00	20.96	-0.04	0.188
A-B :	43	9.00	8.95	-0.05	0.188

s.d(AB): Sw(within run): 0.133      S(between runs): 0.133      S/Sw: 1.00

On any given day the calibration is accepted if the values obtained lie within the ranges:

20.10 to 21.90 for A+B  
8.40 to 9.60 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
72	0.0 - 4.0	0.18	9.13
26	4.0 - 10.0	0.15	2.16
19	10.0 - 20.0	0.45	3.02
117	Overall	0.26	N/A

DETECTION CRITERION: 0.3

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	42	0.00	0.004
Full Scale Abs :	43	0.473	0.1181

# CALCIUM

QUALITY CONTROL DATA FROM 27/02/84 TO 31/08/84

LAB: Rivers and Lakes

Analytical Range: 0.02 to 5.00 mg/L as Ca

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	32	3.00	3.00	-0.00	0.053
B :	31	1.20	1.21	0.01	0.030
A+B :	31	4.20	4.21	0.01	0.076
A-B :	31	1.80	1.79	-0.01	0.042

s.d(AB): Sw(within run): 0.030      S(between runs): 0.043      S/Sw: 1.45

On any given day the calibration is accepted if the values obtained lie within the ranges:

3.98 to 4.43 for A+B  
1.65 to 1.95 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
3	0.00 - 0.50	0.012	4.62
8	0.50 - 2.00	0.030	2.38
100	2.00 - 5.00	0.046	1.32
111	Overall	0.045	N/A

DETECTION CRITERION: 0.02

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	31	0.00	0.000
High Std ABS :	32	0.390	0.0495

\*\*\* CARBON - DISSOLVED INORGANIC \*\*\*

IDENTIFICATION:

Laboratory : Dorset Method Introduced: 03/06/80  
Supervisor : F. Tomassini Units : mg/L as C  
Sample Type/Matrix: Streams, Lakes, Precipitation

SAMPLING:

Quantity Required: 50 mL  
Container : Pyrex culture tubes plus screw caps with cone-shaped liners

ANALYTICAL PROCEDURE:

Dissolved inorganic carbon, which is determined colourimetrically on the supernatant of a settled sample, is converted to carbon dioxide gas by acidification. The gas then passes through a gas-permeable membrane into a weakly-buffered alkaline phenolphthalein solution. The decrease in absorbance of this coloured solution is a measure of the dissolved inorganic carbon content of the sample.

Approximate absorbance: 0.3 at the 10 mg/L level.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: air (CO<sub>2</sub>-free) supply, 60 C heating bath(7.7 mL delay), dialysis unit. Colourimetric measurement is through a 5.0 cm. light path at 550 nm. Two analytical ranges are obtained from the output of the colourimeter.

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.01 Detection Criterion (T): 0.02

CALIBRATION:

BL plus 1 standard daily. BL plus 8 standards whenever a new stock of buffer is prepared.

CONTROLS:

Calibration : LTBL plus 4 standards, eg, QCA  
Drift : BL plus 1 standard every 10 samples

NOTES:

As concentrations of calibration control solutions slowly change with time at these low concentrations, calibration control ranges are based on measured averages rather than expected concentrations.

## CARBON - DISSOLVED INORGANIC

QUALITY CONTROL DATA FROM 14/01/82 TO 17/12/82

LAB: Dorset

Analytical Range: 0.02 to 10.0 mg/L as C

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	102	N/A	7.2	N/A	0.65
B :	102	N/A	2.6	N/A	0.64
A+B :	101	N/A	9.8	N/A	0.67
A-B :	101	N/A	4.7	N/A	1.11
C :	101	N/A	1.46	N/A	0.224
D :	102	N/A	0.62	N/A	0.154
C+D :	100	N/A	2.08	N/A	0.367
C-D :	100	N/A	0.84	N/A	0.094

s.d(AB): Sw(within run): 0.78

S(between runs): 0.65

S/Sw: 0.83

s.d(CD): Sw(within run): 0.067

S(between runs): 0.192

S/Sw: 2.88

On any given day the calibration is accepted if the values obtained lie within the ranges:

Av. Concn- 0.5 to Av. Concn+ 0.5 for A+B

Av. Concn- 0.3 to Av. Concn+ 0.3 for A-B

Av. Concn- 0.09 to Av. Concn+ 0.09 for C+D

Av. Concn- 0.06 to Av. Concn+ 0.06 for C-D

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
22	0.00 - 0.50	0.014	5.64
58	0.50 - 1.00	0.015	1.99
70	1.00 - 2.00	0.030	2.01
47	2.00 - 5.0	0.06	1.85
6	5.0 - 10.0	0.13	1.68
203	Overall	0.05	N/A

DETECTION CRITERION: 0.02

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Standard Cal :	70	7.18	0.386

# CARBON - DISSOLVED INORGANIC

QUALITY CONTROL DATA FROM 06/01/83 TO 21/12/83

LAB: Dorset

Analytical Range: 0.02 to 10.0 mg/L as C

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	116	N/A	6.4	N/A	0.25
B :	116	N/A	2.3	N/A	0.08
A+B :	115	N/A	8.6	N/A	0.30
A-B :	115	N/A	4.1	N/A	0.22
C :	116	N/A	1.41	N/A	0.061
D :	116	N/A	0.60	N/A	0.041
C+D :	115	N/A	2.00	N/A	0.095
C-D :	115	N/A	0.81	N/A	0.042

s.d(AB): Sw(within run): 0.16      S(between runs): 0.19      S/Sw: 1.19  
s.d(CD): Sw(within run): 0.030      S(between runs): 0.052      S/Sw: 1.75

On any given day the calibration is accepted if the values obtained lie within the ranges:

8.2 to 9.1 for A+B  
3.8 to 4.4 for A-B  
1.91 to 2.09 for C+D  
0.75 to 0.87 for C-D

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
74	0.00 - 0.50	0.010	3.88
90	0.50 - 1.00	0.046	6.08
119	1.00 - 2.00	0.024	1.59
56	2.00 - 5.0	0.05	1.39
0	5.0 - 10.0	N/A	N/A
339	Overall	0.04	N/A

DETECTION CRITERION: 0.02

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Standard Cal :	116	6.54	1.155

# CARBON - DISSOLVED INORGANIC

QUALITY CONTROL DATA FROM 05/01/84 TO 20/12/84

LAB: Dorset

Analytical Range: 0.04 to 10.0 mg/L as C

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	164	N/A	6.4	N/A	0.24
B :	164	N/A	2.2	N/A	0.10
A+B :	162	N/A	8.7	N/A	0.31
A-B :	162	N/A	4.2	N/A	0.20
C :	164	N/A	1.39	N/A	0.149
D :	164	N/A	0.63	N/A	0.092
C+D :	163	N/A	2.02	N/A	0.220
C-D :	163	N/A	0.77	N/A	0.116

s.d(AB): Sw(within run): 0.14

S(between runs): 0.19

S/Sw: 1.32

s.d(CD): Sw(within run): 0.082

S(between runs): 0.124

S/Sw: 1.51

On any given day the calibration is accepted if the values obtained lie within the ranges:

8.2 to 9.1 for A+B  
3.9 to 4.5 for A-B  
1.93 to 2.11 for C+D  
0.71 to 0.83 for C-D

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
179	0.00 - 0.50	0.022	8.80
141	0.50 - 1.00	0.024	3.16
116	1.00 - 2.00	0.055	3.67
32	2.00 - 5.0	0.04	1.14
2	5.0 - 10.0	0.04	0.47
470	Overall	0.04	N/A

DETECTION CRITERION: 0.04

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Standard Cal :	161	4.66	0.477



\*\*\* CARBON - DISSOLVED INORGANIC \*\*\*

IDENTIFICATION:

Laboratory : Rivers and Lakes      Method Introduced: 01/04/78  
LIS Test Name Code: DIC      Units : mg/L as C  
Work Station Code : RDC      Unit Code : 064806  
Method Code : 102AC2      Supervisor : J. Crowther  
Sample Type/Matrix: Rivers, Lakes, Precipitation, Soil Extracts, Effluents,  
Domestic Water Supplies, Leachates, Sewages, Industrial Wastes

SAMPLING:

Quantity Required: 50 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

Dissolved inorganic carbon, which is determined colourimetrically on the supernatant of a settled sample, is converted to carbon dioxide gas by acidification. The gas then passes through a gas-permeable membrane into a weakly-buffered alkaline phenolphthalein solution. The decrease in absorbance of this coloured solution is a measure of the dissolved inorganic carbon content of the sample.

Approximate absorbance: 0.4 at the 40 mg/L level.

N.B. Dissolved organic carbon is determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: air (CO<sub>2</sub>-free) supply, dialysis unit. Colourimetric measurement is through a 5.0 cm. light path at 550 nm.

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.2

Detection Criterion (T): 0.3

CALIBRATION:

BL plus 1 standard daily. BL plus 4 standards whenever a new stock of buffer is prepared.

CONTROLS:

Calibration : LTBL plus 2 standards, eg, QCA  
Drift : BL plus 1 standard

# CARBON - DISSOLVED INORGANIC

QUALITY CONTROL DATA FROM 04/01/82 TO 23/12/82

LAB: Rivers and Lakes

Analytical Range: 0.2 to 40.0 mg/L as C

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	184	30.0	30.0	0.0	0.46
B :	183	10.0	10.0	0.0	0.31
A+B :	182	40.0	40.1	0.1	0.68
A-B :	182	20.0	20.0	-0.0	0.40

s.d(AB): Sw(within run): 0.28

S(between runs): 0.39

S/Sw: 1.41

On any given day the calibration is accepted if the values obtained lie within the ranges:

38.2 to 41.8 for A+B  
18.8 to 21.2 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
245	0.0 - 8.0	0.13	3.20
67	8.0 - 20.0	0.17	1.21
155	20.0 - 40.0	0.36	1.20
467	Overall	0.25	N/A

DETECTION CRITERION: 0.2

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	139	0.18	0.167
Standard Cal :	155	370	42.8

# CARBON - DISSOLVED INORGANIC

QUALITY CONTROL DATA FROM 04/01/83 TO 22/12/83

LAB: Rivers and Lakes

Analytical Range: 0.3 to 40.0 mg/L as C

## CALIBRATION CONTROL:

	Number of Data	Expected Concn	Av. Concn Measured	Av. Bias	Standard Deviation
A :	174	30.0	30.2	0.2	0.49
B :	174	10.0	10.4	0.4	0.33
A+B :	173	40.0	40.5	0.5	0.73
A-B :	173	20.0	19.8	-0.2	0.40

s.d(AB): Sw(within run): 0.28      S(between runs): 0.42      S/Sw: 1.47

On any given day the calibration is accepted if the values obtained lie within the ranges:

38.2 to 41.8 for A+B  
18.8 to 21.2 for A-B

## DUPLICATES:

Number of Data Pairs	Sample Concn Span	Mean s.d.	Relative s.d. (%)
206	0.0 - 8.0	0.20	5.09
22	8.0 - 20.0	0.15	1.06
68	20.0 - 40.0	0.31	1.02
296	Overall	0.25	N/A

DETECTION CRITERION: 0.3

## OTHER CHECKS:

	Number of Data	Data Mean	Standard Deviation
Long Term Blank :	148	0.12	0.135
Standard Cal :	80	311	70.8

# CARBON - DISSOLVED INORGANIC

QUALITY CONTROL DATA FROM 03/01/84 TO 22/11/84

LAB: Rivers and Lakes

Analytical Range: 0.3 to 40.0 mg/L as C

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	156	30.0	30.3	0.3	0.37
B :	155	10.0	10.4	0.4	0.32
A+B :	154	40.0	40.7	0.7	0.59
A-B :	154	20.0	19.9	-0.1	0.35

s.d(AB): Sw(within run): 0.25

S(between runs): 0.35

S/Sw: 1.40

On any given day the calibration is accepted if the values obtained lie within the ranges:

38.2 to 41.8 for A+B  
18.8 to 21.2 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
150	0.0 - 8.0	0.18	4.38
47	8.0 - 20.0	0.32	2.27
56	20.0 - 40.0	0.61	2.02
253	Overall	0.37	N/A

DETECTION CRITERION: 0.3

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	135	0.19	0.130
Standard Cal :	129	384	61.0

\*\*\* CARBON - DISSOLVED ORGANIC \*\*\*

IDENTIFICATION:

Laboratory	: Rivers and Lakes	Method Introduced:	01/04/78
LIS Test Name Code:	DOC	Units	: mg/L as C
Work Station Code	: ROC	Unit Code	: 064806
Method Code	: 102AC2	Supervisor	: J. Crowther
Sample Type/Matrix: Rivers, Lakes, Precipitation, Soil Extracts, Effluents, Domestic Waters, Leachates, Sewages, Industrial Wastes			

SAMPLING:

Quantity Required: 50 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

Using an automated system, the supernatant from a settled sample is acidified and flushed with nitrogen gas (500 mL/min) to remove inorganic carbon. Organic carbon is then oxidized to carbon dioxide gas by exposure to ultra-violet light (UV) in acid-persulphate media. The gas then passes through a gas-permeable membrane into a weakly-buffered alkaline phenolphthalein solution. The decrease in absorbance of this coloured solution is a measure of the dissolved organic carbon content of the sample.

Approximate absorbance: 0.3 at the 20 mg/L level.

N.B. Dissolved inorganic carbon is determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: nitrogen and air (CO<sub>2</sub>-free) gas supplies with flow controls, dialysis unit, UV digester. Colourimetric measurement is through a 5.0 cm. light path at 550 nm.

REPORTING:

Maximum Significant Figures: 3

Minimum Increment (W) : 0.1

Detection Criterion (T): 0.2

CALIBRATION:

BL plus 1 standard daily. BL plus 4 standards whenever a new stock of buffer is prepared.

CONTROLS:

Calibration : LTBL plus 2 standards, eg, QCA

Drift : BL plus 1 standard

Interference: Analyses of an inorganic carbon standard confirms effectiveness of inorganic carbon stripping step.

## CARBON - DISSOLVED ORGANIC

QUALITY CONTROL DATA FROM 04/01/82 TO 23/12/82

LAB: Rivers and Lakes

Analytical Range: 0.2 to 20.0 mg/L as C

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	190	15.00	15.08	0.08	0.245
B :	190	5.00	5.02	0.02	0.164
A+B :	189	20.00	20.10	0.10	0.358
A-B :	189	10.00	10.06	0.06	0.215

s.d(AB): Sw(within run): 0.152

S(between runs): 0.208

S/Sw: 1.37

On any given day the calibration is accepted if the values obtained lie within the ranges:

19.10 to 20.90 for A+B  
9.40 to 10.60 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
309	0.0 - 4.0	0.11	5.28
258	4.0 - 10.0	0.24	3.36
53	10.0 - 20.0	0.25	1.69
620	Overall	0.19	N/A

DETECTION CRITERION: 0.2

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	154	0.16	0.125
Standard Cal :	158	521	69.8

# CARBON - DISSOLVED ORGANIC

QUALITY CONTROL DATA FROM 05/01/83 TO 19/12/83

LAB: Rivers and Lakes

Analytical Range: 0.2 to 20.0 mg/L as C

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	173	15.00	15.11	0.11	0.266
B :	173	5.00	5.00	-0.00	0.142
A+B :	172	20.00	20.11	0.11	0.360
A-B :	172	10.00	10.11	0.11	0.228

s.d(AB): Sw(within run): 0.162      S(between runs): 0.213      S/Sw: 1.32

On any given day the calibration is accepted if the values obtained lie within the ranges:

19.10 to 20.90 for A+B  
9.40 to 10.60 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
310	0.0 - 4.0	0.13	6.71
126	4.0 - 10.0	0.16	2.23
19	10.0 - 20.0	0.22	1.46
455	Overall	0.15	N/A

DETECTION CRITERION: 0.2

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	162	0.24	0.499
Standard Cal :	63	559	71.9

## CARBON - DISSOLVED ORGANIC

QUALITY CONTROL DATA FROM 03/01/84 TO 06/12/84

LAB: Rivers and Lakes

Analytical Range: 0.2 to 20.0 mg/L as C

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	164	15.00	15.18	0.18	0.220
B :	164	5.00	5.11	0.11	0.136
A+B :	163	20.00	20.30	0.30	0.293
A-B :	163	10.00	10.07	0.07	0.221

s.d(AB): Sw(within run): 0.156

S(between runs): 0.183

S/Sw: 1.17

On any given day the calibration is accepted if the values obtained lie within the ranges:

19.10 to 20.90 for A+B  
9.40 to 10.60 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
175	0.0 - 4.0	0.15	7.47
168	4.0 - 10.0	0.21	2.94
36	10.0 - 20.0	0.23	1.56
379	Overall	0.19	N/A

DETECTION CRITERION: 0.2

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	147	0.09	0.074
Standard Cal :	135	546	69.1



\*\*\* CARBON - TOTAL PARTICULATE \*\*\*

IDENTIFICATION:

Laboratory : Sewage/Industrial      Method Introduced: 01/04/81  
LIS Test Name Code: PTC              Units : mg/L as C  
Work Station Code : SCARB            Unit Code : 064806  
Method Code : 201AI1                Supervisor : P. Campbell  
Sample Type/Matrix: Sewage, Industrial Waste, Leachates, Domestic Waters,  
Rivers, Lakes, Effluents

SAMPLING:

Quantity Required: 200 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

Sample is filtered through a Whatman 934 AH glass fibre filter. The filter is dried at 103-105 C, placed in a ceramic boat, and then inserted into the Leco furnace where it is fired at 1370 C in an oxygen stream. Readout (% carbon) is converted to mg/L.

INSTRUMENTATION:

- Leco CR-12 carbon analyzer; Leco boats
- Whatman 934 AH glass fibre filters, 4-decimal place balance.

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.1                      Detection Criterion (T): 3

CALIBRATION:

1 standard

CONTROLS:

Calibration: 2 standards, eg, QCA  
Drift : 1 standard every 10 samples

MODIFICATIONS:

01/04/81- The procedure introduced on this date is not described in HAMES, but a development report is available on request.

# CARBON - TOTAL PARTICULATE

QUALITY CONTROL DATA FROM 12/01/82 TO 10/11/82

LAB: Sewage/Industrial

Analytical Range: 2.5 to 100.0 mg/L as C

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	30	31.97	31.80	-0.17	0.573
B :	29	12.00	12.33	0.33	0.335
A+B :	29	43.97	44.11	0.14	0.710
A-B :	29	19.97	19.45	-0.52	0.608

s.d(AB): Sw(within run): 0.430

S(between runs): 0.469

S/Sw: 1.09

On any given day the calibration is accepted if the values obtained lie within the ranges:

41.72 to 46.22 for A+B

18.47 to 21.47 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
9	0.0 - 20.0	1.55	15.50
8	20.0 - 100.0	5.85	9.75
17	Overall	5.31	N/A

DETECTION CRITERION: 2.5

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Leco Constant :	28	14150	551.0

# CARBON - TOTAL PARTICULATE

QUALITY CONTROL DATA FROM 04/01/83 TO 19/07/83

LAB: Sewage/Industrial

Analytical Range: 2.0 to 100.0 mg/L as C

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	17	31.97	31.55	-0.42	0.588
B :	17	12.00	12.20	0.20	0.362
A+B :	17	43.97	43.75	-0.22	0.605
A-B :	17	19.97	19.35	-0.62	0.766

s.d(AB): Sw(within run): 0.541      S(between runs): 0.488      S/Sw: 0.90

On any given day the calibration is accepted if the values obtained lie within the ranges:

41.72 to 46.22 for A+B  
18.47 to 21.47 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
5	0.0 - 20.0	1.22	12.16
10	20.0 - 100.0	4.60	7.67
15	Overall	4.42	N/A

DETECTION CRITERION: 2.0

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Leco Constant :	17	12952	483.8

## CARBON - TOTAL PARTICULATE

QUALITY CONTROL DATA FROM 23/01/84 TO 24/09/84

LAB: Sewage/Industrial

Analytical Range: 5.3 to 100.0 mg/L as C

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	6	31.97	31.49	-0.48	0.885
B :	6	12.00	12.42	0.42	0.508
A+B :	6	43.97	43.91	-0.06	1.341
A-B :	6	19.97	19.07	-0.90	0.532

s.d(AB): Sw(within run): 0.376

S(between runs): 0.721

S/Sw: 1.92

On any given day the calibration is accepted if the values obtained lie within the ranges:

41.72 to 46.22 for A+B  
18.47 to 21.47 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
1	0.0 - 20.0	N/A	N/A
2	20.0 - 100.0	3.24	5.40
3	Overall	3.27	N/A

DETECTION CRITERION: 5.3

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Leco Constant :	5	13623	969.5

\*\*\* CHLORIDE \*\*\*

IDENTIFICATION:

Laboratory	: Domestic Water	Method Introduced:	01/06/66
LIS Test Name Code:	CLIDUR	Units	: mg/L as Cl
Work Station Code	: WCL	Unit Code	: 064817
Method Code	: 002BT3	Supervisor	: M. Rawlings
Sample Type/Matrix: Domestic Waters, Leachates, Sewage, Industrial Waste, Effluents			

SAMPLING:

Quantity Required: 15 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

An aliquot (10.0 mL) of sample is automatically pipetted and titrated with silver nitrate to an endpoint which is determined by calibration. The addition of silver nitrate to a sample containing chloride ions results in the precipitation of silver chloride with a corresponding change in voltage between the electrodes. The endpoint is equivalent to the maximum change in voltage per unit volume of titrant. A reagent containing acetone and nitric acid is utilized to prevent fouling of the electrodes by silver chloride precipitate.

INSTRUMENTATION:

Radiometer ATS-1 autopipetting titration system equipped with a silver-silver chloride electrode and a non-calomel reference electrode.

REPORTING:

Maximum Significant Figures: 4	
Minimum Increment (W) : 0.2	Detection Criterion (T): 0.5

CALIBRATION:

BL plus 2 standards

CONTROLS:

Calibration : 2 standards, eg, QCA  
Drift : Acid wash, BL, plus 1 standard

# CHLORIDE

## QUALITY CONTROL DATA FROM 06/01/82 TO 23/12/82

LAB: Domestic Water

Analytical Range: 2 to 500 mg/L as Cl

### CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	104	170	169	-1	1.6
B :	104	17	17	0	0.6
A+B :	100	187	186	-1	2.1
A-B :	100	153	151	-2	1.4

s.d(AB): Sw(within run): 1.0

S(between runs): 1.2

S/Sw: 1.24

On any given day the calibration is accepted if the values obtained lie within the ranges:

181 to 193 for A+B  
149 to 157 for A-B

### DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
242	0 - 50	1.4	5.67
47	50 - 100	1.3	1.68
65	100 - 250	2.8	1.57
19	250 - 500	6.8	1.81
373	Overall	2.5	N/A

DETECTION CRITERION: 2

# CHLORIDE

QUALITY CONTROL DATA FROM 04/01/83 TO 22/12/83

LAB: Domestic Water

Analytical Range: 3 to 500 mg/L as Cl

## CALIBRATION CONTROL:

	Number of Data	Expected Concn	Av. Concn Measured	Av. Bias	Standard Deviation
A :	124	170	169	-1	1.0
B :	124	17	17	0	0.6
A+B :	123	187	186	-1	1.2
A-B :	123	153	151	-2	1.0

s.d(AB): Sw(within run): 0.7

S(between runs): 0.8

S/Sw: 1.10

On any given day the calibration is accepted if the values obtained lie within the ranges:

181 to 193 for A+B  
149 to 157 for A-B

## DUPLICATES:

Number of Data Pairs	Sample Concn Span	Mean s.d.	Relative s.d. (%)
255	0 - 50	1.8	7.10
43	50 - 100	8.7	11.64
39	100 - 250	13.9	7.95
18	250 - 500	24.1	6.44
355	Overall	8.2	N/A

DETECTION CRITERION: 3

# CHLORIDE

QUALITY CONTROL DATA FROM 06/01/84 TO 14/12/84

LAB: Domestic Water

Analytical Range: 1 to 500 mg/L as Cl

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	101	170	169	-1	1.1
B :	101	17	17	-0	0.5
A+B :	100	187	186	-1	1.4
A-B :	100	153	152	-1	1.1

s.d(AB): Sw(within run): 0.8

S(between runs): 0.9

S/Sw: 1.13

On any given day the calibration is accepted if the values obtained lie within the ranges:

181 to 193 for A+B  
149 to 157 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
250	0 - 50	0.6	2.39
41	50 - 100	0.9	1.16
19	100 - 250	0.7	0.41
15	250 - 500	3.1	0.84
325	Overall	1.1	N/A

DETECTION CRITERION: 1



\*\*\* CHLORIDE \*\*\*

IDENTIFICATION:

Laboratory	: Precipitation	Method Introduced:	01/04/78
LIS Test Name Code:	CLIDUR	Units	: mg/L as Cl
Work Station Code	: PRIC1	Unit Code	: 064817
Method Code	: 005A10	Supervisor	: M. Rawlings
Sample Type/Matrix: Precipitation, Throughfall, Stemflow			

SAMPLING:

Quantity Required: 15 mL  
Container : Polystyrene

ANALYTICAL PROCEDURE:

Chloride is separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of 0.003M sodium bicarbonate and 0.0024M sodium carbonate with conductivity detection. Samples are spiked with Na<sub>2</sub>CO<sub>3</sub>/NaHCO<sub>3</sub> to match the eluent strength and maintain background conductivity. The concentration of chloride in mg/L as Cl is determined by comparison of the sample scan to a series of standard scans.  
Full scale conductivity : 10 uS/cm.  
Nitrate and sulphate are determined simultaneously.

INSTRUMENTATION:

Basic modular continuous flow ion chromatographic system plus microcomputer for automated sample introduction and timing.

REPORTING:

Maximum Significant Figures: 3	
Minimum Increment (W) : 0.01	Detection Criterion (T): 0.03

CALIBRATION:

BL plus 6 standards

CONTROLS:

Calibration : 2 standards, eg, QCA  
Drift : 1 standard every 10 samples

MODIFICATIONS:

20/09/84 - Chloride range was changed from 1.50 mg/L full scale to 2.00 mg/L full scale.

# CHLORIDE

QUALITY CONTROL DATA FROM 06/01/82 TO 24/12/82

LAB: Precipitation

Analytical Range: 0.03 to 1.50 mg/L as Cl

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	248	1.20	1.19	-0.01	0.025
B :	247	0.30	0.30	0.00	0.014
A+B :	246	1.50	1.50	-0.00	0.031
A-B :	246	0.90	0.89	-0.01	0.025

s.d(AB): Sw(within run): 0.018

S(between runs): 0.020

S/Sw: 1.13

On any given day the calibration is accepted if the values obtained lie within the ranges:

1.43 to 1.57 for A+B  
0.86 to 0.95 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
191	0.00 - 0.30	0.020	13.18
71	0.30 - 0.75	0.021	4.02
24	0.75 - 1.50	0.019	1.70
286	Overall	0.020	N/A

DETECTION CRITERION: 0.03

# CHLORIDE

## QUALITY CONTROL DATA FROM 04/01/83 TO 20/12/83

LAB: Precipitation

Analytical Range: 0.03 to 1.50 mg/L as Cl

### CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	297	1.20	1.21	0.01	0.020
B :	295	0.30	0.30	0.00	0.010
A+B :	293	1.50	1.51	0.01	0.019
A-B :	293	0.90	0.91	0.01	0.024

s.d(AB): Sw(within run): 0.017      S(between runs): 0.015      S/Sw: 0.91

On any given day the calibration is accepted if the values obtained lie within the ranges:

1.43 to 1.57 for A+B  
0.86 to 0.95 for A-B

### DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
185	0.00 - 0.30	0.019	12.51
58	0.30 - 0.75	0.025	4.70
8	0.75 - 1.50	0.066	5.85
251	Overall	0.023	N/A

DETECTION CRITERION: 0.03

# CHLORIDE

QUALITY CONTROL DATA FROM 09/01/84 TO 20/12/84

LAB: Precipitation

Analytical Range: 0.03 to 1.50 mg/L as Cl

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	170	1.20	1.21	0.01	0.029
B :	170	0.30	0.30	0.00	0.012
A+B :	169	1.50	1.52	0.02	0.032
A-B :	169	0.90	0.91	0.01	0.029

s.d(AB): Sw(within run): 0.020

S(between runs): 0.022

S/Sw: 1.08

On any given day the calibration is accepted if the values obtained lie within the ranges:

1.43 to 1.57 for A+B  
0.86 to 0.95 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
204	0.00 - 0.30	0.021	13.91
75	0.30 - 0.75	0.018	3.52
18	0.75 - 1.50	0.033	2.94
297	Overall	0.022	N/A

DETECTION CRITERION: 0.03

\*\*\* CHLORIDE \*\*\*

IDENTIFICATION:

Laboratory : Precipitation Method Introduced: 01/04/78  
LIS Test Name Code: CLIDUR Units : ug/Filter as CL  
Work Station Code : PRLOV Unit Code : 361817  
Method Code : 004AIC Supervisor : M. Rawlings  
Sample Type/Matrix: W40 filters from LoVol filter packs.

SAMPLING:

Quantity Required: 1 filter  
Container : Polyethylene bag

SAMPLE PREPARATION:

Filters are extracted with 50.0 mL of DDW in polyethylene tubes with ultrasonic treatment followed by a 24 hour rest period.

ANALYTICAL PROCEDURE:

Chloride is separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of 0.003M sodium bicarbonate and 0.0024M sodium carbonate with conductivity detection. Samples are spiked with Na<sub>2</sub>CO<sub>3</sub>/NaHCO<sub>3</sub> to match the eluent strength and maintain background conductivity. The concentration of chloride in mg/L as Cl is determined by comparison of the sample scan to a series of standard scans. Results are converted to ug/filter as Cl.

Full scale conductivity : 30 uS/cm.

Nitrate and sulphate are determined simultaneously.

INSTRUMENTATION:

Ultrasonic bath; polyethylene tubes  
Basic modular continuous flow ion chromatographic system plus microcomputer for automated sample introduction and timing.

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment(W): 0.50 ug/filter Detection Criterion(T): 0.7 ug/filter

CALIBRATION:

BL plus 6 standards

CONTROLS:

Calibration : 2 standards, eg, QCA  
Drift : 1 standard every 10 samples

MODIFICATIONS:

01/08/81 - Ion chromatographic procedure for precipitation samples was modified for analysis of LoVol W40 filter extracts by developing the above filter extraction procedures.

10/03/84 - Microcomputer for automated sampling and timing was introduced. At that time automated spiking of samples with Na<sub>2</sub>CO<sub>3</sub>/NaHCO<sub>3</sub> was introduced.

20/09/84 - Chloride range was changed from 1.50 mg/L full scale to 2.00 mg/L full scale. Quality control standards were not changed.

NOTES:

Detection criterion is based on duplicate analyses of the extract from one filter because duplicate filters are not received.

# CHLORIDE

QUALITY CONTROL DATA FROM 03/04/84 TO 18/12/84

LAB: Precipitation

Analytical Range: 0.7 to 75.0 ug/filter as Cl

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	22	60.0	60.1	0.1	0.87
B :	22	15.0	15.5	0.5	0.63
A+B :	22	75.0	75.6	0.6	1.03
A-B :	22	45.0	44.6	-0.4	1.11

s.d(AB): Sw(within run): 0.79

S(between runs): 0.76

S/Sw: 0.96

On any given day the calibration is accepted if the values obtained lie within the ranges:

71.6 to 78.4 for A+B  
42.8 to 47.3 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
6	0.0 - 15.0	0.41	5.44
1	15.0 - 37.5	N/A	N/A
0	37.5 - 75.0	N/A	N/A
7	Overall	0.39	N/A

DETECTION CRITERION: 0.7

\*\*\* CHLORIDE \*\*\*

IDENTIFICATION:

Laboratory	: Rivers and Lakes	Method Introduced:	01/05/75
LIS Test Name Code:	CLIDUR	Units	: mg/L as Cl
Work Station Code	: RMSICL	Unit Code	: 064817
Method Code	: 004AC2	Supervisor	: J. Crowther
Sample Type/Matrix: Rivers, Lakes, Soil Extracts, Effluents.			

SAMPLING:

Quantity Required: 50 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

Chloride ions are combined with mercuric thiocyanate releasing thiocyanate quantitatively. Thiocyanate then reacts with ferric ions to produce ferric thiocyanate (red), and the absorbance of the latter is measured colourimetrically. A reference stream, from which mercuric thiocyanate has been eliminated, is utilized to compensate for sample matrix effects. Approximate absorbance: 0.3 at the 50 mg/L level  
N.B. Reactive silicates are determined simultaneously.

INSTRUMENTATION:

Boxed-FIA system consisting of basic automated modular continuous flow system plus the following modules: sample injection valves with air-flow controls, timer, bubble-gate. Colourimetric measurement is through a 1.5 cm. light path at 470 nm. Two analytical ranges are obtained from the output of the colourimeter.

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.05                      Detection Criterion (T): 0.09

CALIBRATION:

BL plus 10 standards

CONTROLS:

Calibration : LTBL plus 4 standards, eg, QCA  
Drift : BL plus 3 standards

MODIFICATIONS:

04/07/83 - Modules required for Boxed-FIA system were introduced. The number of calibration standards was increased from 2 to 10, and concentrations of QC standards were adjusted. The analytical rate was tripled.

# CHLORIDE

QUALITY CONTROL DATA FROM 04/01/82 TO 23/12/82

LAB: Rivers and Lakes

Analytical Range: 0.06 to 50.0 mg/L as Cl

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	130	25.0	26.0	1.0	0.46
B :	130	5.0	5.2	0.2	0.18
A+B :	129	30.0	31.2	1.2	0.51
A-B :	129	20.0	20.8	0.8	0.47
C :	130	5.00	5.12	0.12	0.091
D :	130	4.00	4.10	0.10	0.072
C+D :	129	9.00	9.21	0.21	0.156
C-D :	129	1.00	1.02	0.02	0.054

s.d(AB): Sw(within run): 0.33

S(between runs): 0.35

S/Sw: 1.05

s.d(CD): Sw(within run): 0.038

S(between runs): 0.082

S/Sw: 2.17

On any given day the calibration is accepted if the values obtained lie within the ranges:

27.8 to 32.3 for A+B

18.5 to 21.5 for A-B

8.55 to 9.45 for C+D

0.70 to 1.30 for C-D

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
181	0.00 - 2.00	0.036	3.59
60	2.00 - 5.00	0.059	1.69
32	5.00 - 10.00	0.184	2.46
74	10.00 - 25.0	0.27	1.55
70	25.0 - 50.0	0.21	0.57
417	Overall	0.16	N/A

DETECTION CRITERION: 0.06

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	91	0.00	0.000
Standard Cal :	129	314.1	20.00



# CHLORIDE

QUALITY CONTROL DATA FROM 06/01/83 TO 30/09/83

LAB: Rivers and Lakes

Analytical Range: 0.06 to 50.0 mg/L as Cl

## CALIBRATION CONTROL:

	Number of Data	Expected Concn	Av. Concn Measured	Av. Bias	Standard Deviation
A :	80	25.0	25.0	0.0	0.63
B :	80	5.0	5.0	-0.0	0.12
A+B :	80	30.0	30.0	0.0	0.70
A-B :	80	20.0	20.1	0.1	0.57
C :	79	5.00	4.98	-0.02	0.085
D :	79	4.00	3.98	-0.02	0.085
C+D :	79	9.00	8.96	-0.04	0.156
C-D :	79	1.00	1.01	0.01	0.068

s.d(AB): Sw(within run): 0.40      S(between runs): 0.45      S/Sw: 1.13  
s.d(CD): Sw(within run): 0.048      S(between runs): 0.085      S/Sw: 1.77

On any given day the calibration is accepted if the values obtained lie within the ranges:

27.8 to 32.3 for A+B  
18.5 to 21.5 for A-B  
8.55 to 9.45 for C+D  
0.70 to 1.30 for C-D

## DUPLICATES:

Number of Data Pairs	Sample Concn Span	Mean s.d.	Relative s.d. (%)
165	0.00 - 2.00	0.034	3.38
23	2.00 - 5.00	0.125	3.57
12	5.00 - 10.00	0.048	0.64
49	10.00 - 25.0	0.33	1.89
15	25.0 - 50.0	0.29	0.77
264	Overall	0.19	N/A

DETECTION CRITERION: 0.06

## OTHER CHECKS:

	Number of Data	Data Mean	Standard Deviation
Long Term Blank :	77	0.01	0.011
Standard Cal :	80	289	36.2

# CHLORIDE

QUALITY CONTROL DATA FROM 07/10/83 TO 19/12/84

LAB: Rivers and Lakes

Analytical Range: 0.09 to 50.0 mg/L as Cl

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	102	30.0	29.8	-0.2	0.41
B :	102	8.0	8.0	0.0	0.16
A+B :	101	38.0	37.8	-0.2	0.46
A-B :	101	22.0	21.8	-0.2	0.41
C :	101	8.00	8.02	0.02	0.102
D :	101	2.00	1.97	-0.03	0.056
C+D :	100	10.00	10.00	-0.00	0.123
C-D :	100	6.00	6.05	0.05	0.110

s.d(AB): Sw(within run): 0.29

S(between runs): 0.31

S/Sw: 1.07

s.d(CD): Sw(within run): 0.077

S(between runs): 0.082

S/Sw: 1.06

On any given day the calibration is accepted if the values obtained lie within the ranges:

35.8 to 40.3 for A+B  
20.5 to 23.5 for A-B  
9.55 to 10.45 for C+D  
5.70 to 6.30 for C-D

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
166	0.00 - 2.00	0.058	5.77
31	2.00 - 5.00	0.169	4.83
15	5.00 - 10.00	0.136	1.82
101	10.00 - 25.0	0.50	2.84
31	25.0 - 50.0	0.43	1.14
344	Overall	0.35	N/A

DETECTION CRITERION: 0.09

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	102	0.01	0.007
Standard Cal :	99	484	81.5

\*\*\* CHLOROPHYLL \*\*\*

IDENTIFICATION:

Laboratory : Rivers and Lakes      Method Introduced: 01/04/75  
LIS Test Name Code: CHLRAT,CHLRBT,CHLRAC      Units : ug/L  
Work Station Code : RCHLO      Unit Code : 063000  
Method Code : 002DS1      Supervisor : J. Crowther  
Sample Type/Matrix: Rivers, Lakes, Effluents

SAMPLING:

Quantity Required: 1000 mL  
Container : Glass  
Other : In the field a sample is filtered through a 1.2 u cellulose nitrate membrane filter. The filter is then placed between two membrane filter-support pads, and the package is enclosed in a plastic dish.

SAMPLE PREPARATION:

If the sample has not been filtered in the field, a measured volume is filtered through a 1.2 um cellulose nitrate membrane filter under moderate suction. After the addition of 4.5 mL acetone (90% V/V), the filter is ground to release chlorophyll using glass beads; an additional 4.5 mL acetone (90% V/V) is added, and the mixture is rested overnight to improve extraction efficiency. After filtration through Whatman 934AH glass fibre filters (no suction), the volume is adjusted to 12.0 mL followed by centrifugation.

ANALYTICAL PROCEDURE:

Using a microcomputer-controlled, automated spectrophotometer, two scans are developed with absorbance measurements at 630, 645, and 665 nm; the minimum absorbance value between 710 and 750 nm (readings at 5 nm intervals) is utilized as a turbidity correction. Chlorophyll a and b are calculated from the first scan. After automated acidification, the second scan is obtained for the same wavelengths, and used for calculating chlorophyll a, corrected. SCOR-UNESCO equations are used for all chlorophyll calculations.

INSTRUMENTATION:

-Vacuum filtration modules; centrifuge set at 2500 rpm.  
Automated modular continuous flow scanning spectrophotometer system.  
-Microcomputer system for control of sampling, timing, and data processing (i.e. data capture, calculations, and transfer of results to LIS).

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.01,0.01,0.01      Detection Criterion (T): 0.6,0.3,N/A

CONTROLS:

Calibration : LTBL plus 2 "standards", eg, QCA  
Recovery : BL plus 1 filter impregnated with algae  
Drift : 1 "standard"

MODIFICATIONS:

01/05/82 - Extracting and centrifuging steps, in batches of 24 samples, were introduced.  
01/07/84 -Automated, microcomputer controlled system was introduced.

NOTES:

In '82 calibration controls were stable, but were prepared from dyes rather than chlorophyll. "Standards" are now prepared from chlorophyll a and b, but the materials are neither analytical grade nor are their solutions stable. Thus calibration controls are based on measured averages.

# CHLOROPHYL a

## QUALITY CONTROL DATA FROM 20/07/82 TO 21/12/82

LAB: Rivers and Lakes

Analytical Range: 0.20 to 100 ug/L

### CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	67	8.00	8.16	0.16	0.213
B :	67	2.00	2.63	0.63	0.098
A+B :	67	10.00	10.79	0.79	0.294
A-B :	67	6.00	5.54	-0.46	0.153

s.d(AB): Sw(within run): 0.109

S(between runs): 0.166

S/Sw: 1.53

On any given day the calibration is accepted if the values obtained lie within the ranges:

8.50 to 11.50 for A+B

5.00 to 7.00 for A-B

### DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
16	0.00 - 2.00	0.122	12.23
14	2.00 - 5.00	0.363	10.38
4	5.00 - 10.0	0.35	4.68
7	10.0 - 50.0	1.24	4.13
1	50.0 - 100	N/A	N/A
42	Overall	2.0	N/A

DETECTION CRITERION: 0.20

# CHLOROPHYL a

QUALITY CONTROL DATA FROM 05/01/83 TO 02/12/83

LAB: Rivers and Lakes

Analytical Range: 1.04 to 100 ug/L

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	114	N/A	7.61	N/A	0.819
B :	114	N/A	1.92	N/A	0.224
A+B :	113	N/A	9.54	N/A	1.030
A-B :	113	N/A	5.70	N/A	0.621

s.d(AB): Sw(within run): 0.439

S(between runs): 0.600

S/Sw: 1.37

On any given day the calibration is accepted if the values obtained lie within the ranges:

8.03 to 11.03 for A+B

4.70 to 6.70 for A-B

## RECOVERIES:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Standard Deviation</u>
R1 :	97	N/A	5.70	1.673
R2 :	110	N/A	1.40	0.715

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
49	0.00 - 2.00	0.632	63.20
33	2.00 - 5.00	0.310	8.85
17	5.00 - 10.0	1.03	13.76
12	10.0 - 50.0	3.00	9.99
1	50.0 - 100	N/A	N/A
112	Overall	1.3	N/A

DETECTION CRITERION: 1.04

# CHLOROPHYL a

QUALITY CONTROL DATA FROM 04/01/84 TO 08/05/84

LAB: Rivers and Lakes

Analytical Range: 1.13 to 100 ug/L

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	16	N/A	7.09	N/A	0.277
B :	16	N/A	1.84	N/A	0.089
A+B :	16	N/A	8.93	N/A	0.316
A-B :	16	N/A	5.26	N/A	0.263

s.d(AB): Sw(within run): 0.186      S(between runs): 0.205      S/Sw: 1.10

On any given day the calibration is accepted if the values obtained lie within the ranges:

7.43 to 10.43 for A+B  
4.26 to 6.26 for A-B

## RECOVERIES:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Standard Deviation</u>
R1 :	15	N/A	1.23	0.213
R2 :	15	N/A	5.08	0.436

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
18	0.00 - 2.00	0.688	68.82
14	2.00 - 5.00	0.505	14.42
1	5.00 - 10.0	N/A	N/A
0	10.0 - 50.0	N/A	N/A
0	50.0 - 100	N/A	N/A
33	Overall	0.6	N/A

DETECTION CRITERION: 1.13

# CHLOROPHYLL a

QUALITY CONTROL DATA FROM 29/05/84 TO 08/11/84

LAB: Rivers and Lakes

Analytical Range: 0.60 to 100 ug/L

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	74	N/A	5.84	N/A	0.125
B :	73	N/A	2.06	N/A	0.130
A+B :	73	N/A	7.89	N/A	0.179
A-B :	73	N/A	3.78	N/A	0.181

s.d(AB): Sw(within run): 0.128      S(between runs): 0.127      S/Sw: 0.99

On any given day the calibration is accepted if the values obtained lie within the ranges:

6.39 to 9.39 for A+B  
2.78 to 4.78 for A-B

## RECOVERIES:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Standard Deviation</u>
R1 :	2	N/A	1.87	0.035

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
32	0.00 - 2.00	0.367	36.72
30	2.00 - 5.00	0.411	11.75
10	5.00 - 10.00	0.997	13.29
5	10.00 - 50.0	2.61	8.69
0	50.0 - 100	N/A	N/A
77	Overall	1.2	N/A

DETECTION CRITERION: 0.60

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	65	0.09	0.090

# CHLOROPHYL b

## QUALITY CONTROL DATA FROM 02/12/83 TO 02/12/83

LAB: Rivers and Lakes

Analytical Range: 0.47 to 100 ug/L

### CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
C :	113	N/A	7.50	N/A	0.859
D :	113	N/A	1.83	N/A	0.303
C+D :	112	N/A	9.34	N/A	1.148
C-D :	112	N/A	5.67	N/A	0.593

s.d(CD): Sw(within run): 0.419      S(between runs): 0.644      S/Sw: 1.54

On any given day the calibration is accepted if the values obtained lie within the ranges:

7.83 to 10.83 for C+D  
4.67 to 6.67 for C-D

### RECOVERIES:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Standard Deviation</u>
R1 :	96	N/A	1.77	0.677
R2 :	105	N/A	0.58	0.210

### DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
76	0.00 - 2.00	0.286	28.60
5	2.00 - 5.00	0.926	26.46
1	5.00 - 10.0	N/A	N/A
2	10.0 - 50.0	0.28	0.94
0	50.0 - 100	N/A	N/A
84	Overall	0.6	N/A

DETECTION CRITERION: 0.47



# CHLOROPHYL b

## QUALITY CONTROL DATA FROM 04/01/84 TO 08/05/84

LAB: Rivers and Lakes

Analytical Range: 0.26 to 100 ug/L

### CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
C :	16	N/A	7.26	N/A	0.175
D :	16	N/A	1.76	N/A	0.126
C+D :	16	N/A	9.02	N/A	0.269
C-D :	16	N/A	5.49	N/A	0.144

s.d(CD): Sw(within run): 0.102      S(between runs): 0.152      S/Sw: 1.50

On any given day the calibration is accepted if the values obtained lie within the ranges:

7.52 to 10.52 for C+D  
4.49 to 6.49 for C-D

### RECOVERIES:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Standard Deviation</u>
R1 :	16	N/A	0.63	0.170
R2 :	16	N/A	2.04	0.206

### DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
34	0.00 - 2.00	0.157	15.72
1	2.00 - 5.00	N/A	N/A
0	5.00 - 10.0	N/A	N/A
0	10.0 - 50.0	N/A	N/A
0	50.0 - 100	N/A	N/A
35	Overall	0.2	N/A

DETECTION CRITERION: 0.26

# CHLOROPHYLL b

QUALITY CONTROL DATA FROM 29/05/84 TO 08/11/84

LAB: Rivers and Lakes

Analytical Range: 0.25 to 100 ug/L

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	72	N/A	5.97	N/A	0.205
B :	72	N/A	2.12	N/A	0.223
A+B :	72	N/A	8.09	N/A	0.341
A-B :	72	N/A	3.85	N/A	0.258

s.d(AB): Sw(within run): 0.183

S(between runs): 0.214

S/Sw: 1.17

On any given day the calibration is accepted if the values obtained lie within the ranges:

6.59 to 9.59 for A+B  
2.85 to 4.85 for A-B

## RECOVERIES:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Standard Deviation</u>
R1 :	2	N/A	0.90	0.478

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
67	0.00 - 2.00	0.150	15.04
0	2.00 - 5.00	N/A	N/A
10	5.00 - 10.00	0.503	6.71
2	10.00 - 50.0	2.83	9.43
0	50.0 - 100	N/A	N/A
79	Overall	0.8	N/A

DETECTION CRITERION: 0.25

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	61	0.12	0.140

\*\*\* COLOUR-APPARENT \*\*\*

IDENTIFICATION:

Laboratory	: Domestic Water	Method Introduced:	29/05/78
LIS Test Name Code:	COLAP	Units	: HZU
Work Station Code	: WPCTC	Unit Code	: 341000
Method Code	: 002AC9	Supervisor	: M. Rawlings
Sample Type/Matrix:	Domestic Waters, Leachates, Effluents		

SAMPLING:

Quantity Required: 75 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

Apparent colour is measured colourimetrically in a system calibrated with acidified chloroplatinate standards. Colour is measured using a broadband blue filter. Turbidity effects are partially suppressed by using a broadband red filter. Apparent colour is calculated from the two absorbance measurements using an empirically derived equation. If colour reads >70 or turbidity reads >20, true colour is reported after centrifuging plus dilution if required. Approximate absorbance: 0.05 at the 70 HZU level.

INSTRUMENTATION:

Two colourimeters, one with broadband blue filter (400-450nm) and the other with broadband red filter (660-740nm). Colourimetric measurement is through a 4.0 cm light path.

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.5                      Detection Criterion (T):2

CALIBRATION:

BL plus 1 standard

CONTROLS:

Calibration : LTBL plus 3 standards, eg, QCA

MODIFICATIONS:

15/04/82- Turbidity correction factor was adjusted from 1.68 to 1.60; slope factor was changed from 1.35 to 1.48.  
24/02/84- Method was replaced by true colour procedure.

# COLOUR - APPARENT

QUALITY CONTROL DATA FROM 01/04/82 TO 13/12/82

LAB: Domestic Water

Analytical Range: 1 to 100 HZU

## CALIBRATION CONTROL:

	Number of Data	Expected Concn	Av. Concn Measured	Av. Bias	Standard Deviation
A :	140	60	60	-0	3.1
B :	140	25	26	1	2.1
A+B :	138	85	86	1	4.0
A-B :	138	35	33	-2	3.6
C :	140	5	6	1	1.4

s.d(AB): Sw(within run): 2.5

S(between runs): 2.7

S/Sw: 1.06

s.d(CD): Sw(within run):N/A

S(between runs):N/A

S/Sw:N/A

On any given day the calibration is accepted if the values obtained lie within the ranges:

81 to 90 for A+B  
32 to 38 for A-B

## DUPLICATES:

Number of Data Pairs	Sample Concn Span	Mean s.d.	Relative s.d. (%)
110	0 - 5	0.5	20.51
65	5 - 10	1.6	21.80
64	10 - 25	0.4	2.43
33	25 - 50	1.4	3.72
10	50 - 100	1.3	1.75
282	Overall	1.1	N/A

DETECTION CRITERION: 1

# COLOUR - APPARENT

QUALITY CONTROL DATA FROM 11/01/83 TO 22/12/83

LAB: Domestic Water

Analytical Range: 2 to 100 HZU

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	146	60	59	-1	1.5
B :	146	25	25	-0	1.6
A+B :	145	85	83	-2	2.7
A-B :	145	35	34	-1	1.4
C :	146	5	5	0	0.8

s.d(AB): Sw(within run): 1.0

S(between runs): 1.5

S/Sw: 1.54

s.d(CD): Sw(within run): N/A

S(between runs): N/A

S/Sw: N/A

On any given day the calibration is accepted if the values obtained lie within the ranges:

81 to 90 for A+B  
32 to 38 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
139	0 - 5	1.0	38.66
55	5 - 10	1.0	13.74
70	10 - 25	1.3	7.54
38	25 - 50	1.9	5.06
22	50 - 100	1.7	2.29
324	Overall	1.3	N/A

DETECTION CRITERION: 2

# COLOUR - APPARENT

QUALITY CONTROL DATA FROM 23/01/84 TO 08/03/84

LAB: Domestic Water

Analytical Range: 1 to 100 HZU

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	14	60	58	-2	2.0
B :	14	25	26	1	1.2
A+B :	14	85	84	-1	1.8
A-B :	14	35	32	-3	2.8
C :	14	5	5	0	0.4

s.d(AB): Sw(within run): 1.9

S(between runs): 1.7

S/Sw: 0.85

s.d(CD): Sw(within run):N/A

S(between runs):N/A

S/Sw:N/A

On any given day the calibration is accepted if the values obtained lie within the ranges:

81 to 90 for A+B  
32 to 38 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
15	0 - 5	0.5	20.97
10	5 - 10	0.7	8.70
11	10 - 25	0.6	3.48
4	25 - 50	0.6	1.58
1	50 - 100	N/A	N/A
41	Overall	0.7	N/A

DETECTION CRITERION: 1

\*\*\* COLOUR - APPARENT \*\*\*

IDENTIFICATION:

Laboratory	: Dorset	Method Introduced:	15/10/80
Supervisor	: F. Tomassini	Units	: HZU
Sample Type/Matrix:	Streams, Lakes		

SAMPLING:

Quantity Required: 75 mL  
Container : Polystyrene

ANALYTICAL PROCEDURE:

Apparent colour is measured colourimetrically in a system calibrated with acidified chloroplatinate standards. Colour is measured using a broadband blue filter. Turbidity effects are partially suppressed by using a broadband red filter. Apparent colour is calculated from the two absorbance measurements using an empirically derived equation. If colour reads >70 or turbidity reads >20, true colour is reported after settling plus dilution if required.  
Approximate absorbance: 0.05 at the 70 HZU level.

INSTRUMENTATION:

Two colourimeters, one with broadband blue filter (400-450nm) and the other with broadband red filter (660-740nm). Colourimetric measurement is through a 4.0 cm light path.

REPORTING:

Maximum Significant Figures: 3	
Minimum Increment (W) : 1	Detection Criterion (T):3

CALIBRATION:

BL plus 1 standard

CONTROLS:

Calibration : LTBL plus 2 standards, eg, QCA

NOTES:

Slope factor is changed whenever light source in a colourimeter is replaced. This is accomplished by analyzing 7 standards.

# COLOUR - APPARENT

QUALITY CONTROL DATA FROM 20/01/82 TO 09/09/82

LAB: Dorset

Analytical Range: 2 to 100 HZU

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	119	30	32	2	1.2
B :	119	5	5	0	0.6
A+B :	118	35	37	2	1.5
A-B :	118	25	27	2	1.2

s.d(AB): Sw(within run): 0.9

S(between runs): 1.0

S/Sw: 1.12

On any given day the calibration is accepted if the values obtained lie within the ranges:

32 to 38 for A+B  
23 to 27 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
59	0 - 10	1.5	29.76
102	10 - 30	2.4	12.02
82	30 - 60	1.7	3.76
11	60 - 80	2.0	2.86
11	80 - 100	2.0	2.25
265	Overall	2.0	N/A

DETECTION CRITERION: 2

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	69	0.1	0.26



# COLOUR - APPARENT

QUALITY CONTROL DATA FROM 07/01/83 TO 22/12/83

LAB: Dorset

Analytical Range: 3 to 100 HZU

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	151	50	50	0	1.5
B :	151	10	10	0	0.8
A+B :	150	60	60	0	1.8
A-B :	150	40	40	0	1.5

s.d(AB): Sw(within run): 1.1

S(between runs): 1.2

S/Sw: 1.11

On any given day the calibration is accepted if the values obtained lie within the ranges:

57 to 63 for A+B  
38 to 42 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
90	0 - 10	1.6	32.00
119	10 - 30	2.1	10.54
131	30 - 60	2.0	4.36
48	60 - 80	1.7	2.48
23	80 - 100	1.4	1.56
411	Overall	1.9	N/A

DETECTION CRITERION: 3

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	151	0.0	0.00

# COLOUR - APPARENT

QUALITY CONTROL DATA FROM 06/01/84 TO 21/12/84

LAB: Dorset

Analytical Range: 3 to 100 HZU

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	164	50	50	-0	2.8
B :	165	10	10	0	2.0
A+B :	163	60	60	-0	4.3
A-B :	163	40	40	-0	2.5

s.d(AB): Sw(within run): 1.7

S(between runs): 2.5

S/Sw: 1.41

On any given day the calibration is accepted if the values obtained lie within the ranges:

57 to 63 for A+B  
38 to 42 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
99	0 - 10	1.8	36.81
136	10 - 30	1.5	7.61
99	30 - 60	4.6	10.12
38	60 - 80	1.4	1.93
17	80 - 100	1.3	1.47
389	Overall	2.7	N/A

DETECTION CRITERION: 3

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	164	0.0	0.15

\*\*\* COLOUR-APPARENT \*\*\*

IDENTIFICATION:

Laboratory	: Rivers and Lakes	Method Introduced:	29/05/78
LIS Test Name Code:	COLAP	Units	: HZU
Work Station Code	: ROCOL	Unit Code	: 341000
Method Code	: 002AC9	Supervisor	: J. Crowther
Sample Type/Matrix: Rivers, Lakes, Soil Extracts, Effluents.			

SAMPLING:

Quantity Required: 75 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

Apparent colour is measured colourimetrically in a system calibrated with acidified chloroplatinate standards. Colour is measured using a broadband blue filter. Turbidity effects are partially suppressed by using a broadband red filter. Apparent colour is calculated from the two absorbance measurements using an empirically derived equation. If colour reads >70 or turbidity reads >20, true colour is reported after centrifuging plus dilution if required.  
Approximate absorbance: 0.05 at the 70 HZU level.

INSTRUMENTATION:

Two colourimeters, one with broadband blue filter (400-450nm) and the other with broadband red filter (660-740nm). Colourimetric measurement is through a 4.0 cm light path.

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.1                      Detection Criterion (T):1.0

CALIBRATION:

BL plus 1 standard

CONTROLS:

Calibration : LTBL plus 2 standards, eg, QCA

MODIFICATIONS:

15/04/82- Turbidity correction factor was adjusted from 1.68 to 1.60; slope factor was changed from 1.35 to 1.48.  
24/02/84- Method was replaced by true colour procedure.

# COLOUR - APPARENT

QUALITY CONTROL DATA FROM 07/01/82 TO 30/12/82

LAB: Rivers and Lakes

Analytical Range: 1.0 to 70.0 HZU

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	107	20.0	19.2	-0.8	0.31
B :	107	5.0	5.1	0.1	0.22
A+B :	106	25.0	24.3	-0.7	0.41
A-B :	106	15.0	14.2	-0.8	0.34

s.d(AB): Sw(within run): 0.24

S(between runs): 0.27

S/Sw: 1.11

On any given day the calibration is accepted if the values obtained lie within the ranges:

20.5 to 29.5 for A+B  
12.0 to 18.0 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
46	0.0 - 10.0	0.60	11.92
90	10.0 - 35.0	0.96	4.26
33	35.0 - 70.0	1.23	2.35
169	Overall	0.98	N/A

DETECTION CRITERION: 1.0

# COLOUR - APPARENT

QUALITY CONTROL DATA FROM 17/01/83 TO 09/11/83

LAB: Rivers and Lakes

Analytical Range: 0.6 to 70.0 HZU

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	93	20.0	19.8	-0.2	0.44
B :	92	5.0	5.1	0.1	0.31
A+B :	92	25.0	24.9	-0.1	0.51
A-B :	92	15.0	14.7	-0.3	0.57

s.d(AB): Sw(within run): 0.40      S(between runs): 0.38      S/Sw: 0.95

On any given day the calibration is accepted if the values obtained lie within the ranges:

20.5 to 29.5 for A+B  
12.0 to 18.0 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
56	0.0 - 10.0	0.39	7.72
67	10.0 - 35.0	1.10	4.89
7	35.0 - 70.0	0.55	1.06
130	Overall	0.85	N/A

DETECTION CRITERION: 0.6

\*\*\* COLOUR - TRUE \*\*\*

IDENTIFICATION:

Laboratory	: Domestic Water	Method Introduced:	13/03/84
LIS Test Name Code:	COLTR	Units	: TCU
Work Station Code	: WCQL	Unit Code	: 342000
Method Code	: 102BC9	Supervisor	: M. Rawlings
Sample Type/Matrix: Domestic Waters, Effluents			

SAMPLING:

Quantity Required: 50 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

True colour is measured colourimetrically on the supernatant of a settled sample in a system calibrated with acidified chloroplatinate standards. The sample stream is measured using a broadband blue filter. Residual turbidity effects are suppressed by using a broadband red filter and increased path length in the reference stream.

Approximate absorbance: 0.05 at the 70 TCU level.

INSTRUMENTATION:

Basic automated modular continuous flow system. Colour measurement is through a 3.0 cm. light path using a broadband filter (400-450nm). Turbidity measurement is through a 5.0 cm. light path using a different broadband filter (660-740nm).

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.1                      Detection Criterion (T): 1

CALIBRATION:

BL plus 6 standards

CONTROLS:

Calibration : LTBL plus 2 standards, eg, QCA  
Drift : BL plus 1 standard

NOTES:

New procedure was initiated to conform with change in "Ontario Drinking Water Objectives"; copy of research study is available on request.

# COLOUR - TRUE

QUALITY CONTROL DATA FROM 13/03/84 TO 18/12/84

LAB: Domestic Water

Analytical Range: 1 to 100 TCU

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	44	50	51	1	0.7
B :	44	25	25	0	0.4
A+B :	43	75	76	1	0.9
A-B :	43	25	25	0	0.7
C :	44	5	5	0	0.4

s.d(AB): Sw(within run): 0.5

S(between runs): 0.6

S/Sw: 1.12

s.d(CD): Sw(within run): N/A

S(between runs): N/A

S/Sw: N/A

On any given day the calibration is accepted if the values obtained lie within the ranges:

71 to 80 for A+B  
22 to 28 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
62	0 - 5	0.6	22.88
20	5 - 10	0.3	4.33
29	10 - 25	0.4	2.21
16	25 - 50	0.7	1.85
2	50 - 100	0.4	0.47
129	Overall	0.5	N/A

DETECTION CRITERION: 1

\*\*\* COLOUR - TRUE \*\*\*

IDENTIFICATION:

Laboratory	: Rivers and Lakes	Method Introduced:	28/02/84
LIS Test Name Code:	COLTR	Units	: TCU
Work Station Code	: ROCOL	Unit Code	: 342000
Method Code	: 102BC9	Supervisor	: J. Crowther
Sample Type/Matrix: Rivers, Lakes, Soil Extracts, Effluents.			

SAMPLING:

Quantity Required: 50 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

True colour is measured colourimetrically on the supernatant of a settled sample in a system calibrated with acidified chloroplatinate standards. The sample stream is measured using a broadband blue filter. Residual turbidity effects are suppressed by using a broadband red filter and increased path length in the reference stream.

Approximate absorbance: 0.05 at the 70 TCU level.

INSTRUMENTATION:

Basic automated modular continuous flow system. Colour measurement is through a 3.0 cm. light path using a broadband filter (400-450nm). Turbidity measurement is through a 5.0 cm. light path using a different broadband filter (660-740nm).

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.1                      Detection Criterion (T): 0.6

CALIBRATION:

BL plus 6 standards

CONTROLS:

Calibration : LTBL plus 2 standards, eg, QCA  
Drift : BL plus 1 standard

NOTES:

New procedure was initiated to conform with change in "Ontario Drinking Water Objectives"; copy of research study is available on request.



# COLOUR - TRUE

## QUALITY CONTROL DATA FROM 24/02/84 TO 28/12/84

LAB: Rivers and Lakes

Analytical Range: 0.6 to 90.0 TCU

### CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	38	50.0	50.8	0.8	0.55
B :	38	25.0	25.1	0.1	0.38
A+B :	38	75.0	75.9	0.9	0.79
A-B :	38	25.0	25.6	0.6	0.52

s.d(AB): Sw(within run): 0.37      S(between runs): 0.47      S/Sw: 1.29

On any given day the calibration is accepted if the values obtained lie within the ranges:

70.5 to 79.5 for A+B  
22.0 to 28.0 for A-B

### DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
39	0.0 - 10.0	0.36	7.14
47	10.0 - 40.0	0.52	2.08
16	40.0 - 90.0	0.68	1.05
102	Overall	0.52	N/A

DETECTION CRITERION: 0.6

### OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	38	0.1	0.11
Standard Cal :	39	411	88.2

\*\*\* CONDUCTIVITY \*\*\*

IDENTIFICATION:

Laboratory	: Domestic Water	Method Introduced:	Before '74
LIS Test Name Code:	COND25	Units	: uS/cm at 25 C
Work Station Code	: WPC	Unit Code	: 350351
Method Code	: 002AI2	Supervisor	: M. Rawlings
Sample Type/Matrix:	Domestic Waters, Leachates		

SAMPLING:

Quantity Required: 75 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

The sample is introduced into a jacketed conductivity cell and equilibrated to 25 C. The conductivity is read directly from a digital display.

INSTRUMENTATION

Conductivity meter with cell enclosed in a water jacket; temperature controlled water circulator.

REPORTING:

Maximum Significant Figures: 4  
Minimum Increment (W) : 0.01                      Detection Criterion (T): 0.3

CALIBRATION:

Standard resistor

CONTROLS:

Calibration: BL plus 3 standards, eg, QCA

# CONDUCTIVITY

QUALITY CONTROL DATA FROM 04/01/82 TO 21/12/82

LAB: Domestic Water

Analytical Range: 3 to 5000 uS/cm

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	197	1399	1391	-8	10.9
B :	197	477	477	0	4.7
A+B :	196	1876	1869	-7	13.6
A-B :	196	922	914	-8	9.9
C :	197	477	478	0	4.4
D :	197	193	193	-0	3.8
C+D :	196	671	671	0	6.4
C-D :	196	284	285	1	5.1

s.d(AB): Sw(within run): 7.0

S(between runs): 8.4

S/Sw: 1.20

s.d(CD): Sw(within run): 3.6

S(between runs): 4.1

S/Sw: 1.13

On any given day the calibration is accepted if the values obtained lie within the ranges:

1809	to	1944	for A+B
877	to	967	for A-B
652	to	689	for C+D
272	to	296	for C-D

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
39	0 - 100	2.0	3.94
73	100 - 250	2.6	1.46
188	250 - 500	2.8	0.75
161	500 - 2000	3.9	0.32
8	2000 - 5000	9.9	0.28
469	Overall	3.5	N/A

DETECTION CRITERION: 3

# CONDUCTIVITY

QUALITY CONTROL DATA FROM 11/01/83 TO 21/12/83

LAB: Domestic Water

Analytical Range: 2 to 5000 uS/cm

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	155	1399	1402	3	7.8
B :	155	477	478	1	2.4
A+B :	154	1876	1881	5	9.3
A-B :	154	922	924	2	6.8
C :	155	477	478	1	2.4
D :	155	193	195	2	1.1
C+D :	154	671	674	3	3.0
C-D :	154	284	283	-1	2.2

s.d(AB): Sw(within run): 4.8

S(between runs): 5.7

S/Sw: 1.20

s.d(CD): Sw(within run): 1.5

S(between runs): 1.9

S/Sw: 1.22

On any given day the calibration is accepted if the values obtained lie within the ranges:

1809	to	1944	for A+B
877	to	967	for A-B
652	to	689	for C+D
272	to	296	for C-D

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
46	0 - 100	1.0	1.99
50	100 - 250	1.1	0.61
155	250 - 500	1.2	0.31
92	500 - 2000	2.8	0.22
7	2000 - 5000	4.9	0.14
350	Overall	2.0	N/A

DETECTION CRITERION: 2

# CONDUCTIVITY

QUALITY CONTROL DATA FROM 09/01/84 TO 18/12/84

LAB: Domestic Water

Analytical Range: 1 to 5000 uS/cm

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	150	1399	1390	-9	8.6
B :	149	477	478	1	3.3
A+B :	148	1876	1869	-7	10.8
A-B :	148	922	912	-10	7.2
C :	150	477	478	1	3.3
D :	150	193	195	2	1.0
C+D :	149	671	674	3	4.0
C-D :	149	284	283	-1	2.9

s.d(AB): Sw(within run): 5.1

S(between runs): 6.5

S/Sw: 1.29

s.d(CD): Sw(within run): 2.1

S(between runs): 2.4

S/Sw: 1.19

On any given day the calibration is accepted if the values obtained lie within the ranges:

1809	to	1944	for A+B
877	to	967	for A-B
652	to	689	for C+D
272	to	296	for C-D

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
41	0 - 100	0.5	0.94
60	100 - 250	0.9	0.53
130	250 - 500	1.3	0.35
138	500 - 2000	1.7	0.14
7	2000 - 5000	7.9	0.22
376	Overall	1.8	N/A

DETECTION CRITERION: 1

\*\*\* CONDUCTIVITY \*\*\*

IDENTIFICATION:

Laboratory	: Dorset	Method Introduced:	01/06/76
Supervisor	: F. Tomassini	Units	: uS/cm at 25 C
Sample Type/Matrix:	Streams, Lakes, Precipitation		

SAMPLING:

Quantity Required: 75 mL  
Container : Polystyrene

ANALYTICAL PROCEDURE:

The sample is introduced into a jacketed conductivity cell and equilibrated to 25 C. The conductivity is read directly from a digital display.

INSTRUMENTATION:

Conductivity meter with cell enclosed in a water jacket; temperature controlled water circulator.

REPORTING:

Maximum Significant Figures:	4	
Minimum Increment (W) :	0.1	Detection Criterion (T): 1

CALIBRATION:

None

CONTROLS:

Calibration: BL plus 2 standards, eg, QCA

# CONDUCTIVITY

QUALITY CONTROL DATA FROM 10/03/82 TO 17/12/82

LAB: Dorset

Analytical Range: 1 to 300 uS/cm

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	166	280	285	5	5.9
B :	166	74	74	0	0.9
A+B :	165	354	359	5	6.3
A-B :	165	206	211	5	5.5

s.d(AB): Sw(within run): 3.9      S(between runs): 4.2      S/Sw: 1.07

On any given day the calibration is accepted if the values obtained lie within the ranges:

342 to 366 for A+B  
198 to 214 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
349	0 - 50	0.5	1.82
18	50 - 100	0.8	1.05
10	100 - 200	0.7	0.47
2	200 - 300	1.4	0.57
379	Overall	0.5	N/A

DETECTION CRITERION: 1

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	164	1.4	0.52

# CONDUCTIVITY

QUALITY CONTROL DATA FROM 06/01/83 TO 22/12/83

LAB: Dorset

Analytical Range: 1 to 300 uS/cm

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	156	290	290	0	1.3
B :	156	74	75	1	0.7
A+B :	155	364	365	1	1.7
A-B :	155	216	216	-0	1.1

s.d(AB): Sw(within run): 0.8

S(between runs): 1.0

S/Sw: 1.30

On any given day the calibration is accepted if the values obtained lie within the ranges:

352 to 376 for A+B  
208 to 224 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
371	0 - 50	0.7	2.91
33	50 - 100	1.1	1.52
22	100 - 200	1.7	1.16
3	200 - 300	0.6	0.23
429	Overall	0.9	N/A

DETECTION CRITERION: 1

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	156	1.7	0.60



# CONDUCTIVITY

QUALITY CONTROL DATA FROM 06/01/84 TO 22/12/84

LAB: Dorset

Analytical Range: 1 to 300 uS/cm

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	167	290	292	2	2.2
B :	167	74	75	1	0.7
A+B :	166	364	366	2	2.5
A-B :	166	216	217	1	2.1

s.d(AB): Sw(within run): 1.5

S(between runs): 1.6

S/Sw: 1.11

On any given day the calibration is accepted if the values obtained lie within the ranges:

352 to 376 for A+B  
208 to 224 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
347	0 - 50	0.9	3.41
41	50 - 100	0.6	0.82
6	100 - 200	0.1	0.09
3	200 - 300	0.6	0.23
397	Overall	0.8	N/A

DETECTION CRITERION: 1

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	170	2.5	5.51

\*\*\* CONDUCTIVITY \*\*\*

IDENTIFICATION:

Laboratory	: Precipitation	Method Introduced:	01/04/78
LIS Test Name Code:	COND25	Units	: uS/cm at 25 C
Work Station Code	: PRICI	Unit Code	: 350351
Method Code	: 002A12	Supervisor	: M Rawlings
Sample Type/Matrix: Precipitation, Throughfall, Stemflow			

SAMPLING:

Quantity Required: 25 mL  
Container : Polystyrene

ANALYTICAL PROCEDURE:

After equilibration at 25 C, the conductivity of the sample is measured.

INSTRUMENTATION:

Automated modular continuous flow conductivity system comprised of sampler, water bath, conductivity meter with cell, chart recorder.

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.1                      Detection Criterion (T): 0.4

CALIBRATION:

Compatibility between conductivity meter and chart recorder is confirmed by checking 3 standard resistances

CONTROLS:

Calibration: LTBL plus 2 standards, eg, QCA  
Drift : 1 solution every 10 samples

MODIFICATIONS:

18/10/83 -Automated continuous flow system was introduced.

NOTES:

A calibration standard for the ion chromatographic system is utilized as a drift control for the conductivity system, but its theoretical conductivity is unknown.

# CONDUCTIVITY

QUALITY CONTROL DATA FROM 05/01/82 TO 06/12/82

LAB: Precipitation

Analytical Range: 0.4 to 250 uS/cm

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	102	73.9	74.5	0.6	1.30
B :	102	14.9	17.3	2.3	1.09
A+B :	101	88.8	91.9	3.0	1.73
A-B :	101	59.0	57.3	-1.6	1.54

s.d(AB): Sw(within run): 1.09      S(between runs): 1.20      S/Sw: 1.10

On any given day the calibration is accepted if the values obtained lie within the ranges:

79.8 to 97.8 for A+B  
53.0 to 65.0 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
78	0.0 - 20.0	0.22	2.21
60	20.0 - 50.0	0.43	1.23
9	50.0 - 100.0	0.67	0.90
5	100.0 - 250	0.4	0.26
152	Overall	0.4	N/A

DETECTION CRITERION: 0.4

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
STD Resistance :	102	1586.6	5.91

# CONDUCTIVITY

QUALITY CONTROL DATA FROM 04/01/83 TO 23/09/83

LAB: Precipitation

Analytical Range: 0.2 to 250 uS/cm

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	65	73.9	74.4	0.5	0.84
B :	65	14.9	16.7	1.8	0.72
A+B :	65	88.8	91.1	2.2	0.83
A-B :	65	59.0	57.6	-1.3	1.32

s.d(AB): Sw(within run): 0.94

S(between runs): 0.78

S/Sw: 0.84

On any given day the calibration is accepted if the values obtained lie within the ranges:

79.8 to 97.8 for A+B  
53.0 to 65.0 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
34	0.0 - 20.0	0.13	1.32
25	20.0 - 50.0	0.23	0.65
5	50.0 - 100.0	0.42	0.56
2	100.0 - 250	0.7	0.40
66	Overall	0.2	N/A

DETECTION CRITERION: 0.2

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
STD Resistance :	65	1584.2	4.96

# CONDUCTIVITY

QUALITY CONTROL DATA FROM 03/02/84 TO 20/12/84

LAB: Precipitation

Analytical Range: 0.4 to 100 uS/cm

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	66	44.5	46.0	1.5	2.26
B :	72	7.5	9.4	1.9	0.98
A+B :	66	52.0	55.5	3.5	2.88
A-B :	66	37.0	36.4	-0.6	1.94

s.d(AB): Sw(within run): 1.37      S(between runs): 1.74      S/Sw: 1.27

On any given day the calibration is accepted if the values obtained lie within the ranges:

43.0 to 61.0 for A+B  
31.0 to 43.0 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
25	0.0 - 10.0	0.22	4.36
46	10.0 - 20.0	0.79	5.27
82	20.0 - 50.0	1.28	3.65
14	50.0 - 100	0.6	0.85
167	Overall	1.0	N/A

DETECTION CRITERION: 0.4

\*\*\* CONDUCTIVITY \*\*\*

IDENTIFICATION:

Laboratory	: Rivers and Lakes	Method Introduced:	01/04/74
LIS Test Name Code:	COND25	Units	: uS/cm at 25 C
Work Station Code	: ROCONTUR	Unit Code	: 350351
Method Code	: 002B12	Supervisor	: J. Crowther
Sample Type/Matrix:	Rivers, Lakes, Soil Extracts, Effluents		

SAMPLING:

Quantity Required: 25 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

After equilibration at 25 C, the conductivity of the sample is measured. If conductivity is <20 or > 1000 uS/cm, the sample is re-analyzed using the manual procedure.

INSTRUMENTATION:

Automated modular continuous flow conductivity system comprising sampler, water bath, conductivity meter with cell, chart recorder.

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.1                      Detection Criterion (T): 0.5

CALIBRATION:

-Compatibility between conductivity meter and chart recorder is confirmed using 2 standards  
-BL plus 2 standards

CONTROLS:

Calibration : LTBL plus 4 standards, eg, QCA  
Drift : BL plus 2 standards

MODIFICATIONS:

01/04/84 -Automated system introduced for conductivity range 20-1000 uS/cm.

NOTES:

When the conductivity of a sample is less than 20 uS/cm, it is remeasured using the manual procedure described in HAMES. Thus the detection criterion remains 0.5 uS/cm for this parameter.

# CONDUCTIVITY

QUALITY CONTROL DATA FROM 04/01/82 TO 23/12/82

LAB: Rivers and Lakes

Analytical Range: 0.01 to 2500 uS/cm

## CALIBRATION CONTROL:

	Number of Data	Expected Concn	Av. Concn Measured	Av. Bias	Standard Deviation
C :	175	718	707	-11	9.2
D :	175	147	149	2	1.3
C+D :	174	865	856	-9	9.7
C-D :	174	571	559	-12	9.0

s.d(CD): Sw(within run): 6.3

S(between runs): 6.6

S/Sw: 1.04

On any given day the calibration is accepted if the values obtained lie within the ranges:

835 to 895 for C+D  
551 to 591 for C-D

## DUPLICATES:

Number of Data Pairs	Sample Concn Span	Mean s.d.	Relative s.d. (%)
6	0.00 - 20.00	0.008	0.08
66	20.00 - 50.0	0.25	0.72
168	50.0 - 250	0.9	0.59
384	250 - 1000	3.5	0.55
28	1000 - 2500	3.3	0.19
652	Overall	2.8	N/A

DETECTION CRITERION: 0.01

# CONDUCTIVITY

QUALITY CONTROL DATA FROM 04/01/83 TO 13/12/83

LAB: Rivers and Lakes

Analytical Range: 0.5 to 2500 uS/cm

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
C :	187	718	689	-29	13.9
D :	187	147	149	2	3.2
C+D :	186	865	838	-27	16.1
C-D :	186	571	540	-31	12.2

s.d(CD): Sw(within run): 8.6

S(between runs): 10.1

S/Sw: 1.17

On any given day the calibration is accepted if the values obtained lie within the ranges:

835 to 895 for C+D  
551 to 591 for C-D

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
1	0.00 - 20.00	N/A	N/A
51	20.00 - 50.0	0.30	0.85
140	50.0 - 250	0.7	0.49
348	250 - 1000	1.1	0.18
29	1000 - 2500	2.0	0.11
570	Overall	1.1	N/A

DETECTION CRITERION: 0.5



# CONDUCTIVITY

QUALITY CONTROL DATA FROM 27/06/84 TO 26/11/84

LAB: Rivers and Lakes

Analytical Range: 20.00 to 1000 uS/cm

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	50	718	720	2	1.8
B :	49	291	292	1	1.9
A+B :	48	1009	1012	3	2.9
A-B :	48	427	428	1	2.3
C :	50	147	148	1	0.8
D :	50	38	37	-1	0.3
C+D :	50	185	185	1	0.9
C-D :	50	110	111	2	0.8

s.d(AB): Sw(within run): 1.7

S(between runs): 1.8

S/Sw: 1.12

s.d(CD): Sw(within run): 0.6

S(between runs): 0.6

S/Sw: 1.03

On any given day the calibration is accepted if the values obtained lie within the ranges:

998	to	1020	for A+B
420	to	435	for A-B
155	to	215	for C+D
90	to	130	for C-D

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
0	0.00 - 20.00	N/A	N/A
8	20.00 - 50.0	0.74	2.11
51	50.0 - 250	1.3	0.86
100	250 - 1000	3.8	0.60
159	Overall	3.2	N/A

DETECTION CRITERION: 20.00

\*\*\* CONDUCTIVITY \*\*\*

IDENTIFICATION:

Laboratory	: Sewage/Industrial	Method Introduced:	Before '74
LIS Test Name Code:	COND25	Units	: uS/cm at 25 C
Work Station Code	: COND-SEW	Unit Code	: 350351
Method Code	: 002AI2	Supervisor	: P. Campbell
Sample Type/Matrix:	Sewage, Industrial Waste, Effluents		

SAMPLING:

Quantity Required: 75 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

The sample is introduced into a jacketed conductivity cell and equilibrated to 25 C. The conductivity is read directly from an analog display.

INSTRUMENTATION

Conductivity meter with cell enclosed in a water jacket; temperature controlled water circulator.

REPORTING:

Maximum Significant Figures:	3	
Minimum Increment (W) :	1	Detection Criterion (T): 3

CALIBRATION:

None

CONTROLS:

Calibration: BL plus 3 standards, eg, QCA

# CONDUCTIVITY

QUALITY CONTROL DATA FROM 25/01/82 TO 23/11/82

LAB: Sewage/Industrial

Analytical Range: 6 to 5000 uS/cm

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	52	1413	1403	-10	6.5
B :	52	718	713	-5	5.5
A+B :	52	2131	2116	-15	10.6
A-B :	52	695	690	-6	5.7

s.d(AB): Sw(within run): 4.0

S(between runs): 6.0

S/Sw: 1.50

On any given day the calibration is accepted if the values obtained lie within the ranges:

2108 to 2153 for A+B  
680 to 710 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
18	0 - 500	3.5	1.40
10	500 - 1000	5.4	0.72
11	1000 - 1500	3.9	0.31
12	1500 - 5000	4.7	0.14
51	Overall	4.3	N/A

DETECTION CRITERION: 6

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Dist Water Blank :	21	1.1	0.25

# CONDUCTIVITY

QUALITY CONTROL DATA FROM 01/01/83 TO 31/12/83

LAB: Sewage/Industrial

Analytical Range: 3 to 5000 uS/cm

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	36	1413	1407	-6	6.5
B :	36	718	717	-1	3.3
A+B :	36	2131	2125	-6	7.1
A-B :	36	695	690	-5	5.8

s.d(AB): Sw(within run): 4.1

S(between runs): 5.2

S/Sw: 1.26

On any given day the calibration is accepted if the values obtained lie within the ranges:

2108 to 2153 for A+B  
680 to 710 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
11	0 - 500	1.6	0.64
18	500 - 1250	3.4	0.39
6	1250 - 5000	0.0	0.00
35	Overall	2.7	N/A

DETECTION CRITERION: 3

# CONDUCTIVITY

QUALITY CONTROL DATA FROM 01/01/84 TO 31/12/84

LAB: Sewage/Industrial

Analytical Range: 5 to 5000 uS/cm

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	45	1413	1403	-10	5.8
B :	45	718	715	-3	4.8
A+B :	45	2131	2119	-12	8.8
A-B :	45	695	688	-7	6.0

s.d(AB): Sw(within run): 4.2

S(between runs): 5.3

S/Sw: 1.25

On any given day the calibration is accepted if the values obtained lie within the ranges:

2101 to 2161 for A+B  
675 to 715 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
10	0 - 500	3.1	1.24
29	500 - 1250	1.9	0.22
3	1250 - 5000	0.0	0.00
42	Overall	2.3	N/A

DETECTION CRITERION: 5

\*\*\* FLUORIDE \*\*\*

IDENTIFICATION:

Laboratory	: Domestic Water	Method Introduced:	01/03/78
LIS Test Name Code:	FFIDUR	Units	: ug/L as F
Work Station Code	: WSPF	Unit Code	: 063809
Method Code	: 001AIE	Supervisor	: M. Rawlings
Sample Type/Matrix: Precipitation, Lakes, Streams			

SAMPLING:

Quantity Required: 50 mL  
Container : Polystyrene

ANALYTICAL PROCEDURE:

Fluoride is determined via an automated flow system for which the detector is a specific ion electrode; prior to measurement the sample is mixed with a high ionic strength buffer containing: sodium citrate, disodium ethylenediaminetetraacetate(EDTA), phosphoric acid, and sufficient sodium hydroxide to obtain pH 6.7

INSTRUMENTATION:

Automated modular continuous flow ion specific electrode system.

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.5                      Detection Criterion (T): 1.0

CALIBRATION:

BL plus 1 standard

CONTROLS:

Calibration : 2 standards, eg, QCA  
Drift : BL plus 1 standard  
Interference: Combined fluoride and aluminum standard confirms that aluminum is not an interference.

MODIFICATIONS:

01/03/82- The above procedure is not described in HAMES, but a copy of the development report is available on request. The manual procedure in HAMES for the determination of fluoride by specific ion electrode is similar.

NOTES:

At the present time this procedure is restricted to special projects.

# FLUORIDE

## QUALITY CONTROL DATA FROM 15/03/83 TO 21/12/83

LAB: Domestic Water

Analytical Range: 0.5 to 50.0 ug/L as F

### CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	56	48.0	47.9	-0.1	0.95
B :	56	24.0	23.8	-0.2	0.82
A+B :	56	72.0	71.7	-0.3	1.35
A-B :	56	24.0	24.1	0.1	1.15

s.d(AB): Sw(within run): 0.82

S(between runs): 0.89

S/Sw: 1.09

On any given day the calibration is accepted if the values obtained lie within the ranges:

69.8 to 74.3 for A+B  
22.5 to 25.5 for A-B

### DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
0	0.0 - 10.0	N/A	N/A
7	10.0 - 25.0	0.33	1.86
100	25.0 - 50.0	0.77	2.05
107	Overall	0.75	N/A

DETECTION CRITERION: 0.5

# FLUORIDE

QUALITY CONTROL DATA FROM 03/01/84 TO 13/12/84

LAB: Domestic Water

Analytical Range: 0.3 to 50.0 ug/L as F

## CALIBRATION CONTROL:

	Number of Data	Expected Concn	Av. Concn Measured	Av. Bias	Standard Deviation
A :	81	48.0	48.3	0.3	0.65
B :	81	24.0	24.0	-0.0	0.76
A+B :	81	72.0	72.3	0.3	1.05
A-B :	81	24.0	24.4	0.4	0.96

s.d(AB): Sw(within run): 0.68

S(between runs): 0.71

S/Sw: 1.05

On any given day the calibration is accepted if the values obtained lie within the ranges:

69.8 to 74.3 for A+B  
22.5 to 25.5 for A-B

## DUPLICATES:

Number of Data Pairs	Sample Concn Span	Mean s.d.	Relative s.d. (%)
7	0.0 - 10.0	0.21	4.14
15	10.0 - 25.0	0.51	2.92
154	25.0 - 50.0	0.79	2.11
176	Overall	0.77	N/A

DETECTION CRITERION: 0.3



\*\*\* FLUORIDE \*\*\*

IDENTIFICATION:

Laboratory	: Domestic Water	Method Introduced:	Before '74
LIS Test Name Code:	FFIDUR	Units	: mg/L as F
Work Station Code	: WFN03 or WFF	Unit Code	: 064809
Method Code	: 003AC2	Supervisor	: M. Rawlings
Sample Type/Matrix:	Domestic Waters, Surface Waters, Leachates, Effluents		

SAMPLING:

Quantity Required: 50 mL  
Container : Glass or plastic (polystyrene)

ANALYTICAL PROCEDURE:

Using an automated flow system the sample is distilled in the presence of sulphuric acid at 160 C; the distillate is then reacted (in an acetic acid-acetate buffer media) with Alizarin Blue and lanthanum nitrate to form a ternary Alizarin Blue-lanthanide-fluoride complex.  
Approximate absorbance is 0.6 at the 2.0 mg/L level

INSTRUMENTATION:

Modular continuous flow colourimetric system plus a distillation module.  
Colourimetric measurement is through a 5.0 cm light path at 630 nm.

REPORTING:

Maximum Significant Figures: 3	
Minimum Increment (W) : 0.01	Detection Criterion (T): 0.02

CALIBRATION:

BL plus 2 standards

CONTROLS:

Calibration : 2 standards, eg, QCA  
Drift : BL plus 2 standards

# FLUORIDE

## QUALITY CONTROL DATA FROM 05/01/82 TO 23/12/82

LAB: Domestic Water

Analytical Range: 0.02 to 2.00 mg/L as F

### CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	94	1.50	1.47	-0.03	0.035
B :	94	0.30	0.32	0.02	0.016
A+B :	94	1.80	1.79	-0.01	0.044
A-B :	94	1.20	1.15	-0.05	0.032

s.d(AB): Sw(within run): 0.023      S(between runs): 0.027      S/Sw: 1.19

On any given day the calibration is accepted if the values obtained lie within the ranges:

1.68 to 1.92 for A+B  
1.12 to 1.28 for A-B

### DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
199	0.00 - 0.40	0.010	4.77
30	0.40 - 1.00	0.074	10.53
11	1.00 - 2.00	0.021	1.38
240	Overall	0.029	N/A

DETECTION CRITERION: 0.02

# FLUORIDE

QUALITY CONTROL DATA FROM 04/01/83 TO 21/12/83

LAB: Domestic Water

Analytical Range: 0.01 to 2.00 mg/L as F

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	77	1.50	1.47	-0.03	0.025
B :	77	0.30	0.30	0.00	0.009
A+B :	77	1.80	1.77	-0.03	0.028
A-B :	77	1.20	1.17	-0.03	0.026

s.d(AB): Sw(within run): 0.019      S(between runs): 0.019      S/Sw: 1.03

On any given day the calibration is accepted if the values obtained lie within the ranges:

1.68 to 1.92 for A+B  
1.12 to 1.28 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
173	0.00 - 0.40	0.008	4.09
23	0.40 - 1.00	0.008	1.21
16	1.00 - 2.00	0.015	1.00
212	Overall	0.009	N/A

DETECTION CRITERION: 0.01

# FLUORIDE

QUALITY CONTROL DATA FROM 04/01/84 TO 21/12/84

LAB: Domestic Water

Analytical Range: 0.01 to 2.00 mg/L as F

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	88	1.50	1.49	-0.01	0.127
B :	93	0.30	0.32	0.02	0.092
A+B :	88	1.80	1.80	-0.00	0.146
A-B :	88	1.20	1.18	-0.02	0.110

s.d(AB): Sw(within run): 0.078      S(between runs): 0.111      S/Sw: 1.43

On any given day the calibration is accepted if the values obtained lie within the ranges:

1.68 to 1.92 for A+B  
1.12 to 1.28 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
209	0.00 - 0.40	0.009	4.26
24	0.40 - 1.00	0.006	0.84
18	1.00 - 2.00	0.013	0.86
251	Overall	0.009	N/A

DETECTION CRITERION: 0.01

\*\*\* HARDNESS \*\*\*

IDENTIFICATION:

Laboratory	: Domestic Water	Method Introduced:	01/04/75
LIS Test Name Code:	HARDT	Units	: mg/L as CaCO <sub>3</sub>
Work Station Code	: WHCA	Unit Code	: 064915
Method Code	: 001BT1	Supervisor	: M. Rawlings
Sample Type/Matrix:	Domestic Waters, Rivers, Lakes, Effluents		

SAMPLING:

Quantity Required: 100 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

Samples are buffered to a pH of 10 and titrated with disodium ethylenediaminetetraacetate (EDTA) to the Eriochrome Black T endpoint.

INSTRUMENTATION:

Radiometer autoburette ABU-1C and phototitration PMT 1 assembly.

REPORTING:

Maximum Significant Figures: 4  
Minimum Increment (W) : 0.2                      Detection Criterion (T): 1

CALIBRATION:

BL plus 2 standards

CONTROLS:

Calibration : 2 standards, eg, QCA

MODIFICATIONS:

01/07/82- The above procedure for the measurement of hardness was discontinued. Subsequently, calcium and magnesium were measured directly, and hardness was calculated using the equation:

$$\text{Hardness (mg/L as CaCO}_3\text{)} = 2.497(\text{Ca, mg/L}) + 4.118(\text{Mg, mg/L})$$

# HARDNESS

QUALITY CONTROL DATA FROM 04/01/82 TO 09/07/82

LAB: Domestic Water

Analytical Range: 1 to 1000 mg/L as CaCO<sub>3</sub>

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	111	233	233	0	1.0
B :	111	93	94	1	1.0
A+B :	110	326	327	1	1.5
A-B :	110	140	138	-1	1.3

s.d(AB): Sw(within run): 0.9

S(between runs): 1.0

S/Sw: 1.11

On any given day the calibration is accepted if the values obtained lie within the ranges:

321 to 330 for A+B  
137 to 143 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
1	0 - 20	N/A	N/A
15	20 - 50	0.7	2.03
22	50 - 100	0.8	1.13
172	100 - 500	1.7	0.56
15	500 - 1000	1.7	0.22
225	Overall	1.6	N/A

DETECTION CRITERION: 1

\*\*\* IRON - TOTAL \*\*\*

IDENTIFICATION:

Laboratory	: Domestic Water	Method Introduced:	20/04/76
LIS Test Name Code:	FEUT	Units	: mg/L as Fe
Work Station Code	: WFEMN	Unit Code	: 064826
Method Code	: 504BC2	Supervisor	: M. Rawlings
Sample Type/Matrix: Domestic Waters, Leachates, Sewage, Industrial Waste, Effluents			

SAMPLING:

Quantity Required: 100 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

Samples (25.0 mL) are autoclaved in sulphuric acid-hydroxylamine media at 121 C for 45 min. The iron content of the digestate is determined colourimetrically by formation of the ferrous-2,4,6-Tri(2'pyridyl)-1,3,5-triazine (TPTZ) complex in a buffered system.

Approximate absorbance : 0.5 at the 2.0 mg/L level.

N.B. Manganese is determined simultaneously.

INSTRUMENTATION:

Autoclave plus basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 600 nm.

REPORTING:

Maximum Significant Figures: 3

Minimum Increment (W) : 0.01

Detection Criterion (T): 0.04

CALIBRATION:

BL plus 1 undigested standard

CONTROLS:

Calibration : LTBL plus 2 undigested standards, eg, QCA

Recovery : Digested BL plus 2 digested standards, eg, R1

Drift : BL plus 1 undigested standard

NOTES:

Calibration standards are prepared from a hydrate:  $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$ .

Results are corrected using a digested blank value.

# IRON - TOTAL

QUALITY CONTROL DATA FROM 05/01/82 TO 22/12/82

LAB: Domestic Water

Analytical Range: 0.04 to 2.00 mg/L as Fe

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	61	1.40	1.41	0.01	0.024
B :	61	0.28	0.29	0.01	0.022
A+B :	61	1.68	1.70	0.02	0.042
A-B :	61	1.12	1.12	0.00	0.019

s.d(AB): Sw(within run): 0.014      S(between runs): 0.023      S/Sw: 1.69

On any given day the calibration is accepted if the values obtained lie within the ranges:

1.55 to 1.82 for A+B  
1.03 to 1.21 for A-B

## RECOVERIES:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Standard Deviation</u>
R1 :	57	1.40	1.43	0.086
R2 :	56	0.28	0.29	0.038

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
69	0.00 - 0.40	0.022	10.95
26	0.40 - 1.00	0.029	4.17
8	1.00 - 2.00	0.030	2.01
103	Overall	0.025	N/A

DETECTION CRITERION: 0.04



# IRON - TOTAL

QUALITY CONTROL DATA FROM 12/01/83 TO 22/12/83

LAB: Domestic Water

Analytical Range: 0.04 to 2.00 mg/L as Fe

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	73	1.40	1.37	-0.03	0.048
B :	73	0.28	0.29	0.01	0.015
A+B :	73	1.68	1.66	-0.02	0.052
A-B :	73	1.12	1.08	-0.04	0.050

s.d(AB): Sw(within run): 0.035      S(between runs): 0.036      S/Sw: 1.02

On any given day the calibration is accepted if the values obtained lie within the ranges:

1.55 to 1.82 for A+B  
1.03 to 1.21 for A-B

## RECOVERIES:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Standard Deviation</u>
R1 :	69	1.40	1.39	0.095
R2 :	69	0.28	0.30	0.033

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
82	0.00 - 0.40	0.022	11.10
30	0.40 - 1.00	0.019	2.71
12	1.00 - 2.00	0.025	1.69
124	Overall	0.022	N/A

DETECTION CRITERION: 0.04

# IRON - TOTAL

QUALITY CONTROL DATA FROM 02/01/84 TO 19/12/84

LAB: Domestic Water

Analytical Range: 0.02 to 2.00 mg/L as Fe

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	109	1.40	1.41	0.01	0.015
B :	109	0.28	0.29	0.01	0.009
A+B :	108	1.68	1.70	0.02	0.020
A-B :	108	1.12	1.11	-0.01	0.015

s.d(AB): Sw(within run): 0.010      S(between runs): 0.012      S/Sw: 1.21

On any given day the calibration is accepted if the values obtained lie within the ranges:

1.55 to 1.82 for A+B  
1.03 to 1.21 for A-B

## RECOVERIES:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Standard Deviation</u>
R1 :	109	1.40	1.42	0.087
R2 :	107	0.28	0.31	0.025

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
202	0.00 - 0.40	0.014	7.01
58	0.40 - 1.00	0.042	6.06
27	1.00 - 2.00	0.044	2.94
287	Overall	0.027	N/A

DETECTION CRITERION: 0.02

\*\*\* IRON-TOTAL \*\*\*

IDENTIFICATION:

Laboratory : Rivers and Lakes      Method Introduced: 20/04/76  
LIS Test Name Code: FEUT      Units : mg/L as Fe  
Work Station Code : RFEMN      Unit Code : 064826  
Method Code : 504AC2      Supervisor : J. Crowther  
Sample Type/Matrix: Rivers, Lakes, Domestic Water Supplies, Effluents, Soil Extracts

SAMPLING:

Quantity Required: 50 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

Samples (20.0 mL) are autoclaved in sulphuric acid-hydroxylamine media at 121 C for 30 min. The iron content of the digestate is determined colourimetrically by formation of the ferrous-2,4,6-Tri(2'pyridyl)-1,3,5-triazine (TPTZ) complex in a buffered system.

Approximate absorbance : 0.3 at the 1.0 mg/L level.

INSTRUMENTATION:

-Culture tubes with silicone rubber septa and tube racks constructed to maintain seal during digestion step.  
-Autoclave plus basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 600 nm.

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.01      Detection Criterion (T): 0.03

CALIBRATION:

BL plus 1 undigested standard

CONTROLS:

Calibration : LTBL plus 2 undigested standards, eg, QCA  
Recovery : Digested BL plus 2 digested standards, eg, R1  
Drift : BL plus 1 undigested standard

MODIFICATIONS:

06/06/84 - Volume of digested aliquot was decreased from 30.0 to 20.0 mL to accommodate new sampler; concentration of digestion reagent was altered, but concentrations of all constituents remained unchanged at the flow cell. Autoclave digestion period was decreased from 40 to 30 min. Closures for culture tubes were changed to silicone rubber septa.

NOTES:

Calibration standards are prepared from a hydrate:  $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$ . Results are not corrected using a digested blank value as average concentration of latter is less than 0.010 mg/L as Fe.

# IRON - TOTAL

QUALITY CONTROL DATA FROM 05/01/82 TO 30/12/82

LAB: Rivers and Lakes

Analytical Range: 0.02 to 1.00 mg/L as Fe

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	131	0.60	0.61	0.01	0.007
B :	131	0.40	0.40	0.00	0.006
A+B :	130	1.00	1.01	0.01	0.013
A-B :	130	0.20	0.21	0.01	0.005

s.d(AB): Sw(within run): 0.003      S(between runs): 0.007      S/Sw: 2.14

On any given day the calibration is accepted if the values obtained lie within the ranges:

0.96 to 1.05 for A+B  
0.17 to 0.23 for A-B

## RECOVERIES:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Standard Deviation</u>
R1 :	310	0.80	0.84	0.021
R2 :	238	0.20	0.21	0.009

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
317	0.00 - 0.20	0.010	10.14
105	0.20 - 0.50	0.034	9.80
34	0.50 - 1.00	0.015	2.00
456	Overall	0.019	N/A

DETECTION CRITERION: 0.02

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	128	0.00	0.004
Digested Blank :	343	0.00	0.005
Standard Cal :	132	114.7	16.92

# IRON - TOTAL

QUALITY CONTROL DATA FROM 04/01/83 TO 05/06/84

LAB: Rivers and Lakes

Analytical Range: 0.04 to 1.00 mg/L as Fe

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	185	0.60	0.61	0.01	0.008
B :	185	0.40	0.41	0.01	0.007
A+B :	184	1.00	1.02	0.02	0.013
A-B :	184	0.20	0.20	0.00	0.008

s.d(AB): Sw(within run): 0.006      S(between runs): 0.008      S/Sw: 1.27

On any given day the calibration is accepted if the values obtained lie within the ranges:

0.96 to 1.05 for A+B  
0.17 to 0.23 for A-B

## RECOVERIES:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Standard Deviation</u>
R1 :	372	0.80	0.81	0.122
R2 :	358	0.20	0.21	0.026

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
484	0.00 - 0.20	0.023	23.14
135	0.20 - 0.50	0.042	11.88
49	0.50 - 1.00	0.058	7.71
668	Overall	0.032	N/A

DETECTION CRITERION: 0.04

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	187	0.00	0.003
Digested Blank :	528	0.00	0.005
Standard Cal :	189	307	167.6

# IRON - TOTAL

QUALITY CONTROL DATA FROM 06/06/84 TO 19/12/84

LAB: Rivers and Lakes

Analytical Range: 0.03 to 1.00 mg/L as Fe

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	66	0.80	0.80	0.00	0.005
B :	66	0.20	0.20	0.00	0.003
A+B :	65	1.00	1.01	0.01	0.007
A-B :	65	0.60	0.60	0.00	0.005

s.d(AB): Sw(within run): 0.003      S(between runs): 0.004      S/Sw: 1.23

On any given day the calibration is accepted if the values obtained lie within the ranges:

0.96 to 1.05 for A+B  
0.57 to 0.63 for A-B

## RECOVERIES:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Standard Deviation</u>
R1 :	128	0.80	0.80	0.027
R2 :	131	0.20	0.22	0.010

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
151	0.00 - 0.20	0.016	16.44
63	0.20 - 0.50	0.014	3.88
27	0.50 - 1.00	0.032	4.26
241	Overall	0.018	N/A

DETECTION CRITERION: 0.03

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	66	0.00	0.002
Digested Blank :	191	0.02	0.009
Standard Cal :	66	499	9.7

\*\*\* MAGNESIUM \*\*\*

IDENTIFICATION:

Laboratory	: Domestic Water	Method Introduced:	01/07/82
LIS Test Name Code:	MGUR	Units	: mg/L as Mg
Work Station Code	: WCAMGH	Unit Code	: 064812
Method Code	: 001AA1	Supervisor	: M. Rawlings
Sample Type/Matrix: Domestic Waters, Leachates, Effluents			

SAMPLING:

Quantity Required: 100 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

Samples are analyzed by AAS at 285.2 nm using an air-acetylene flame. Acidified lanthanum chloride is added as a releasing agent via an automated sampling train.

Approximate absorbance: 0.15 at the 20 mg/L level

INSTRUMENTATION:

Automated modular continuous flow atomic absorption system(AAS). Two analytical ranges are obtained from the output of the AAS.

REPORTING:

Maximum Significant Figures: 3	
Minimum Increment (W) : 0.05	Detection Criterion (T): 0.2

CALIBRATION:

BL plus 2 standards

CONTROLS:

Calibration : LTBL plus 3 standards, eg, QCA  
Drift : BL plus 3 standards

MODIFICATIONS:

01/07/82- The method introduced on this date differed slightly from Method B for magnesium in HAMES in that full scale was 20.0 mg/L; concentrations of QC standards were also adjusted.

# MAGNESIUM

QUALITY CONTROL DATA FROM 06/07/82 TO 23/12/82

LAB: Domestic Water

Analytical Range: 0.3 to 80 mg/L as Mg

## CALIBRATION CONTROL:

	Number of Data	Expected Concn	Av. Concn Measured	Av. Bias	Standard Deviation
A :	53	52	51	-1	1.2
B :	53	13	13	-0	0.6
A+B :	53	65	64	-1	1.6
A-B :	53	39	38	-1	0.9
C :	53	13.0	13.1	0.1	0.34
D :	53	2.6	2.6	0.0	0.13
C+D :	53	15.6	15.7	0.1	0.39
C-D :	53	10.4	10.5	0.1	0.34

s.d(AB): Sw(within run): 0.6      S(between runs): 0.9      S/Sw: 1.44  
s.d(CD): Sw(within run): 0.24      S(between runs): 0.26      S/Sw: 1.07

On any given day the calibration is accepted if the values obtained lie within the ranges:

61 to 69 for A+B  
37 to 41 for A-B  
14.7 to 16.5 for C+D  
9.8 to 11.0 for C-D

## DUPLICATES:

Number of Data Pairs	Sample Concn Span	Mean s.d.	Relative s.d. (%)
24	0.0 - 4.0	0.21	10.25
30	4.0 - 10.0	0.66	9.48
36	10.0 - 20.0	0.66	4.40
27	20.0 - 40	0.8	2.78
10	40 - 80	1.0	1.69
127	Overall	0.7	N/A

DETECTION CRITERION: 0.3



# MAGNESIUM

QUALITY CONTROL DATA FROM 05/01/83 TO 30/12/83

LAB: Domestic Water

Analytical Range: 0.2 to 80 mg/L as Mg

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	109	52	52	0	0.8
B :	109	13	13	-0	0.6
A+B :	108	65	65	0	1.0
A-B :	108	39	40	1	1.1
C :	109	13.0	13.1	0.1	0.21
D :	109	2.6	2.6	0.0	0.14
C+D :	108	15.6	15.7	0.1	0.27
C-D :	108	10.4	10.5	0.1	0.23

s.d(AB): Sw(within run): 0.7

S(between runs): 0.7

S/Sw: 0.96

s.d(CD): Sw(within run): 0.16

S(between runs): 0.18

S/Sw: 1.10

On any given day the calibration is accepted if the values obtained lie within the ranges:

61 to 69 for A+B

37 to 41 for A-B

14.7 to 16.5 for C+D

9.8 to 11.0 for C-D

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
66	0.0 - 4.0	0.12	6.01
82	4.0 - 10.0	0.27	3.90
70	10.0 - 20.0	0.51	3.41
63	20.0 - 40	0.7	2.20
13	40 - 80	0.6	1.00
294	Overall	0.5	N/A

DETECTION CRITERION: 0.2

# MAGNESIUM

QUALITY CONTROL DATA FROM 06/01/84 TO 17/12/84

LAB: Domestic Water

Analytical Range: 0.2 to 80 mg/L as Mg

## CALIBRATION CONTROL:

	Number of Data	Expected Concn	Av. Concn Measured	Av. Bias	Standard Deviation
A :	110	52	52	-0	1.1
B :	110	13	13	0	0.5
A+B :	109	65	65	-0	1.3
A-B :	109	39	38	-1	1.2
C :	110	13.0	13.2	0.2	0.20
D :	110	2.6	2.6	0.0	0.12
C+D :	109	15.6	15.8	0.2	0.25
C-D :	109	10.4	10.5	0.1	0.20

s.d(AB): Sw(within run): 0.8      S(between runs): 0.9      S/Sw: 1.05  
s.d(CD): Sw(within run): 0.14      S(between runs): 0.16      S/Sw: 1.13

On any given day the calibration is accepted if the values obtained lie within the ranges:

61 to 69 for A+B  
37 to 41 for A-B  
14.7 to 16.5 for C+D  
9.8 to 11.0 for C-D

## DUPLICATES:

Number of Data Pairs	Sample Concn Span	Mean s.d.	Relative s.d. (%)
40	0.0 - 4.0	0.12	5.76
92	4.0 - 10.0	0.15	2.09
82	10.0 - 20.0	0.18	1.23
82	20.0 - 40	0.4	1.24
17	40 - 80	0.4	0.73
313	Overall	0.3	N/A

DETECTION CRITERION: 0.2

\*\*\* MAGNESIUM \*\*\*

IDENTIFICATION:

Laboratory	: Precipitation	Method Introduced:	18/05/79
LIS Test Name Code:	MGUR	Units	: mg/L as Mg
Work Station Code	: PRAA	Unit Code	: 064812
Method Code	: 001CA1	Supervisor	: M. Rawlings
Sample Type/Matrix: Precipitation, Throughfall, Stemflow.			

SAMPLING:

Quantity Required: 25 mL  
Container : Polystyrene

ANALYTICAL PROCEDURE:

Samples are analysed by AAS at 285.2 nm with an air-acetylene flame. Acidified lanthanum chloride is added as a releasing agent via an automated sampling train.

Approximate absorbance: 0.5 at the 0.50 mg/L level.

INSTRUMENTATION:

Automated modular continuous flow atomic absorption spectrophotometer (AAS) system

REPORTING:

Maximum Significant Figures: 3	
Minimum Increment (W) : 0.005	Detection Criterion (T): 0.008

CALIBRATION:

BL plus 6 standards

CONTROLS:

Calibration : 2 standards, eg, QCA  
Drift : BL plus 2 standards every 10 samples

# MAGNESIUM

QUALITY CONTROL DATA FROM 05/01/82 TO 22/12/82

LAB: Precipitation

Analytical Range: 0.007 to 0.500 mg/L as Mg

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	86	0.300	0.292	-0.008	0.0050
B :	86	0.050	0.046	-0.004	0.0045
A+B :	86	0.350	0.338	-0.012	0.0066
A-B :	86	0.250	0.245	-0.005	0.0068

s.d(AB): Sw(within run): 0.0048      S(between runs): 0.0048      S/Sw: 0.99

On any given day the calibration is accepted if the values obtained lie within the ranges:

0.328 to 0.373 for A+B  
0.235 to 0.265 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
54	0.000 - 0.100	0.0043	8.65
25	0.100 - 0.250	0.0113	6.44
11	0.250 - 0.500	0.0078	2.09
90	Overall	0.0077	N/A

DETECTION CRITERION: 0.007

# MAGNESIUM

## QUALITY CONTROL DATA FROM 06/01/83 TO 21/12/83

LAB: Precipitation

Analytical Range: 0.008 to 0.500 mg/L as Mg

### CALIBRATION CONTROL:

	Number of Data	Expected Concn	Av. Concn Measured	Av. Bias	Standard Deviation
A :	44	0.300	0.296	-0.004	0.0076
B :	44	0.050	0.049	-0.001	0.0037
A+B :	44	0.350	0.345	-0.005	0.0093
A-B :	44	0.250	0.247	-0.003	0.0075

s.d(AB): Sw(within run): 0.0053      S(between runs): 0.0060      S/Sw: 1.13

On any given day the calibration is accepted if the values obtained lie within the ranges:

0.328 to 0.373 for A+B  
0.235 to 0.265 for A-B

### DUPLICATES:

Number of Data Pairs	Sample Concn Span	Mean s.d.	Relative s.d. (%)
12	0.000 - 0.100	0.0050	9.96
1	0.100 - 0.250	N/A	N/A
3	0.250 - 0.500	0.0029	0.77
16	Overall	0.0046	N/A

DETECTION CRITERION: 0.008

# MAGNESIUM

QUALITY CONTROL DATA FROM 03/01/84 TO 09/12/84

LAB: Precipitation

Analytical Range: 0.007 to 0.500 mg/L as Mg

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	56	0.300	0.298	-0.002	0.0054
B :	56	0.050	0.049	-0.001	0.0044
A+B :	56	0.350	0.348	-0.003	0.0074
A-B :	56	0.250	0.249	-0.001	0.0064

s.d(AB): Sw(within run): 0.0046      S(between runs): 0.0049      S/Sw: 1.08

On any given day the calibration is accepted if the values obtained lie within the ranges:

0.328 to 0.373 for A+B  
0.235 to 0.265 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
77	0.000 - 0.100	0.0045	9.02
15	0.100 - 0.250	0.0042	2.38
9	0.250 - 0.500	0.0093	2.47
101	Overall	0.0052	N/A

DETECTION CRITERION: 0.007

\*\*\* MAGNESIUM \*\*\*

IDENTIFICATION:

Laboratory	: Rivers and Lakes	Method Introduced:	01/04/74
LIS Test Name Code:	MBUR	Units	: mg/L as Mg
Work Station Code	: RMCAMGH,RMCAMGL	Unit Code	: 064812
Method Code	: 001AA1,001BA1	Supervisor	: J. Crowther
Sample Type/Matrix:	Rivers, Lakes, Soil Extracts, Effluents.		

SAMPLING:

Quantity Required: 50 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

Samples are analyzed by AAS at 285.2 nm using an air-acetylene flame. Acidified lanthanum chloride is added as a releasing agent via an automated sampling train.

Approximate absorbance: 0.9 at full scale for both analytical ranges

INSTRUMENTATION:

Automated modular continuous flow atomic absorption system(AAS).

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.02, 0.01      Detection Criterion (T): 0.09, 0.02

CALIBRATION:

BL plus 10 standards

CONTROLS:

Calibration : LTBL plus 2 standards, eg, QCA for each analytical range  
Drift : BL plus 1 standard

MODIFICATIONS:

01/12/81- Calibration range became 5.00 mg/L full scale; second analytical range was dropped.

01/03/84- Analytical range(RMCAMGL) was added; full scale:1.00 mg/L. This range is currently restricted to special programs.

01/09/84- Analytical range(RMCAMGH) was increased from 5.00 to 10.0 mg/L full scale. Calibration technique was changed from quadratric to linear interpolation. Calcium is no longer determined simultaneously.

# MAGNESIUM

## QUALITY CONTROL DATA FROM 06/01/82 TO 23/12/82

LAB: Rivers and Lakes

Analytical Range: 0.07 to 5.00 mg/L as Mg

### CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	71	3.50	3.41	-0.09	0.035
B :	71	1.40	1.37	-0.03	0.032
A+B :	71	4.90	4.78	-0.12	0.052
A-B :	71	2.10	2.04	-0.06	0.043

s.d(AB): Sw(within run): 0.030      S(between runs): 0.034      S/Sw: 1.12

On any given day the calibration is accepted if the values obtained lie within the ranges:

4.68 to 5.13 for A+B  
1.95 to 2.25 for A-B

### DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
145	0.00 - 1.00	0.045	9.06
42	1.00 - 2.50	0.068	3.90
12	2.50 - 5.00	0.092	2.46
199	Overall	0.056	N/A

DETECTION CRITERION: 0.07

### OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	28	0.00	0.000
Full Scale Abs :	68	0.584	0.1784



# MAGNESIUM

QUALITY CONTROL DATA FROM 05/01/83 TO 22/12/83

LAB: Rivers and Lakes

Analytical Range: 0.07 to 5.00 mg/L as Mg

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	66	3.50	3.39	-0.11	0.052
B :	66	1.40	1.36	-0.04	0.028
A+B :	66	4.90	4.75	-0.15	0.065
A-B :	66	2.10	2.03	-0.07	0.053

s.d(AB): Sw(within run): 0.037

S(between runs): 0.042

S/Sw: 1.12

On any given day the calibration is accepted if the values obtained lie within the ranges:

4.68 to 5.13 for A+B  
1.95 to 2.25 for A-B

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
158	0.00 - 1.00	0.042	8.37
39	1.00 - 2.50	0.049	2.78
15	2.50 - 5.00	0.132	3.53
212	Overall	0.059	N/A

DETECTION CRITERION: 0.07

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	65	0.00	0.000
Full Scale Abs :	64	0.681	0.2052

# MAGNESIUM

QUALITY CONTROL DATA FROM 06/01/84 TO 29/08/84

LAB: Rivers and Lakes

Analytical Range: 0.09 to 5.00 mg/L as Mg

## CALIBRATION CONTROL:

	Number of Data	Expected Concn	Av. Concn Measured	Av. Bias	Standard Deviation
A :	42	3.50	3.43	-0.07	0.080
B :	40	1.40	1.37	-0.03	0.037
A+B :	40	4.90	4.80	-0.10	0.110
A-B :	40	2.10	2.06	-0.04	0.059

s.d(AB): Sw(within run): 0.042      S(between runs): 0.063      S/Sw: 1.51

On any given day the calibration is accepted if the values obtained lie within the ranges:

4.68 to 5.13 for A+B  
1.95 to 2.25 for A-B

## DUPLICATES:

Number of Data Pairs	Sample Concn Span	Mean s.d.	Relative s.d. (%)
63	0.00 - 1.00	0.054	10.77
33	1.00 - 2.50	0.073	4.17
21	2.50 - 5.00	0.093	2.47
117	Overall	0.070	N/A

DETECTION CRITERION: 0.09

## OTHER CHECKS:

	Number of Data	Data Mean	Standard Deviation
Long Term Blank :	41	0.00	0.004
Full Scale Abs :	42	0.750	0.1177

# MAGNESIUM

QUALITY CONTROL DATA FROM 27/02/84 TO 31/08/84

LAB: Rivers and Lakes

Analytical Range: 0.02 to 1.00 mg/L as Mg

## CALIBRATION CONTROL:

	Number of Data	Expected Concn	Av. Concn Measured	Av. Bias	Standard Deviation
A :	31	0.75	0.69	-0.06	0.013
B :	30	0.25	0.28	0.03	0.006
A+B :	30	1.00	0.97	-0.03	0.016
A-B :	30	0.50	0.41	-0.09	0.012

s.d(AB): Sw(within run): 0.008

S(between runs): 0.010

S/Sw: 1.20

On any given day the calibration is accepted if the values obtained lie within the ranges:

0.96 to 1.05 for A+B  
0.47 to 0.53 for A-B

## DUPLICATES:

Number of Data Pairs	Sample Concn Span	Mean s.d.	Relative s.d. (%)
3	0.00 - 0.10	0.012	23.09
4	0.10 - 0.40	0.014	5.66
85	0.40 - 1.00	0.014	2.06
92	Overall	0.014	N/A

DETECTION CRITERION: 0.02

## OTHER CHECKS:

	Number of Data	Data Mean	Standard Deviation
Long Term Blank :	30	0.00	0.000
High Std ABS :	31	0.749	0.1024

\*\*\* MANGANESE \*\*\*

IDENTIFICATION:

Laboratory	: Domestic Water	Method Introduced:	01/05/83
LIS Test Name Code:	MNUT	Units	: mg/L as Mn
Work Station Code	: WFEMN	Unit Code	: 064825
Method Code	: 504BC2	Supervisor	: M. Rawlings
Sample Type/Matrix: Domestic Waters, Sewage, Leachates, Effluents			

SAMPLING:

Quantity Required: 100 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

Samples (25.0 mL) are autoclaved in sulphuric acid-hydroxylamine media at 121 C for 45 min. The manganese content of the digestate is determined colourimetrically by formation of the manganese-formaldehyde complex in a buffered system; this system is designed to suppress interferences from cations such as iron. A reference stream, based on an inverted order of reagent addition, is also required for suppression of cation interference.  
Approximate absorbance : 0.3 at the 0.5 mg/L level.  
N.B. Iron is determined simultaneously.

INSTRUMENTATION:

-Autoclave plus basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 480 nm .

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.002                      Detection Criterion (T): 0.02

CALIBRATION:

BL plus 1 undigested standard

CONTROLS:

Calibration : LTBL plus 2 undigested standards, eg, QCA  
Recovery : Digested BL plus 2 digested standards, eg, R1  
Drift : BL plus 1 undigested standard  
Interference: Iron standard confirms suppression of cation interference.

MODIFICATIONS:

01/05/83- The method introduced on this date differed from Method A for manganese in HAMES in that full scale was 0.5 mg/L. Concentrations of QC standards were also adjusted.

NOTES:

Calibration standards are prepared from a hydrate:  $MnCl2.4H2O$   
Results are corrected using a digested blank value.

# MANGANESE - TOTAL

QUALITY CONTROL DATA FROM 28/07/83 TO 23/12/83

LAB: Domestic Water

Analytical Range: 0.006 to 0.500 mg/L as Mn

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	47	0.350	0.341	-0.009	0.0316
B :	47	0.070	0.070	-0.000	0.0032
A+B :	47	0.420	0.410	-0.010	0.0319
A-B :	47	0.280	0.271	-0.009	0.0316

s.d(AB): Sw(within run): 0.0223      S(between runs): 0.0225      S/Sw: 1.01

On any given day the calibration is accepted if the values obtained lie within the ranges:

0.384 to 0.456 for A+B  
0.256 to 0.304 for A-B

## RECOVERIES:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Standard Deviation</u>
R1 :	47	0.350	0.297	0.0507
R2 :	47	0.070	0.066	0.0039

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
46	0.000 - 0.050	0.0036	14.45
9	0.050 - 0.200	0.0137	10.94
1	0.200 - 0.500	N/A	N/A
56	Overall	0.0077	N/A

DETECTION CRITERION: 0.006

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Digested Blank :	47	0.006	0.0098
Standard Cal :	47	440.1	6.36

# MANGANESE - TOTAL

QUALITY CONTROL DATA FROM 17/01/84 TO 19/12/84

LAB: Domestic Water

Analytical Range: 0.022 to 0.500 mg/L as Mn

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	109	0.350	0.345	-0.005	0.0068
B :	109	0.070	0.069	-0.001	0.0027
A+B :	108	0.420	0.415	-0.005	0.0086
A-B :	108	0.280	0.276	-0.004	0.0058

s.d(AB): Sw(within run): 0.0041      S(between runs): 0.0052      S/Sw: 1.26

On any given day the calibration is accepted if the values obtained lie within the ranges:

0.384 to 0.456 for A+B  
0.256 to 0.304 for A-B

## RECOVERIES:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Standard Deviation</u>
R1 :	109	0.350	0.343	0.0189
R2 :	109	0.070	0.070	0.0038

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
213	0.000 - 0.050	0.0132	52.60
50	0.050 - 0.200	0.0493	39.42
19	0.200 - 0.500	0.0035	0.99
282	Overall	0.0237	N/A

DETECTION CRITERION: 0.022

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Digested Blank :	109	0.005	0.0000
Standard Cal :	108	485.1	25.54

\*\*\* MANGANESE \*\*\*

IDENTIFICATION:

Laboratory : Rivers and Lakes      Method Introduced: 01/10/76  
LIS Test Name Code: MNUT      Units : mg/L as Mn  
Work Station Code : RFEMN      Unit Code : 064825  
Method Code : 504AC2      Supervisor : J. Crowther  
Sample Type/Matrix: Rivers, Lakes, Domestic Water Supplies, Effluents, Soil  
Extracts

SAMPLING:

Quantity Required: 50 mL  
Container : Glass or plastic

ANALYTICAL PROCEDURE:

Samples (20.0 mL) are autoclaved in sulphuric acid-hydroxylamine media at 121 C for 30 min. The manganese content of the digestate is determined colourimetrically by formation of the manganese-formaldoxime complex in a buffered system; this system is designed to suppress interferences from cations such as iron. A reference stream, based on an inverted order of reagent addition, is also required for suppression of cation interference. Approximate absorbance : 0.06 at the 0.2 mg/L level  
N.B. Iron is determined simultaneously.

INSTRUMENTATION:

-Culture tubes with silicone rubber septa and tube racks constructed to maintain seal during digestion step.  
-Autoclave plus basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 480 nm .

REPORTING:

Maximum Significant Figures: 3  
Minimum Increment (W) : 0.001      Detection Criterion (T): 0.003

CALIBRATION:

BL plus 1 undigested standards

CONTROLS:

Calibration : LTBL plus 2 undigested standards, eg, QCA  
Recovery : Digested BL plus 2 digested standards, eg, R1  
Drift : BL plus 1 undigested standard  
Interference: Iron standard confirms suppression of cation interference.

MODIFICATIONS:

06/06/84 - Volume of digested aliquot was decreased from 30.0 to 20.0 mL to accommodate new sampler; concentration of digestion reagent was altered, but concentrations of all constituents remained unchanged at the flow cell. Autoclave digestion period was decreased from 40 to 30 min. Closures for culture tubes were changed to silicone rubber septa.

NOTES:

Calibration standards are prepared from a hydrate:  $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$   
Results are not corrected using a digested blank value as concentration of latter is less than 0.001 mg/L as Mn.

# MANGANESE - TOTAL

QUALITY CONTROL DATA FROM 05/01/82 TO 30/12/82

LAB: Rivers and Lakes

Analytical Range: 0.003 to 0.200 mg/L as Mn

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	127	0.120	0.122	0.002	0.0015
B :	127	0.080	0.081	0.001	0.0010
A+B :	126	0.200	0.203	0.003	0.0023
A-B :	126	0.040	0.041	0.001	0.0010

s.d(AB): Sw(within run): 0.0007      S(between runs): 0.0012      S/Sw: 1.70

On any given day the calibration is accepted if the values obtained lie within the ranges:

0.191 to 0.209 for A+B  
0.034 to 0.046 for A-B

## RECOVERIES:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Standard Deviation</u>
R1 :	295	0.160	0.158	0.0045
R2 :	229	0.040	0.038	0.0015

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
292	0.000 - 0.040	0.0016	8.02
104	0.040 - 0.100	0.0025	3.60
32	0.100 - 0.200	0.0051	3.40
428	Overall	0.0026	N/A

DETECTION CRITERION: 0.003

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	126	0.001	0.0008
Digested Blank :	337	0.001	0.0010
Standard Cal :	127	350.4	7.85



# MANGANESE - TOTAL

QUALITY CONTROL DATA FROM 05/01/83 TO 04/06/84

LAB: Rivers and Lakes

Analytical Range: 0.008 to 0.200 mg/L as Mn

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	189	0.120	0.121	0.001	0.0017
B :	189	0.080	0.081	0.001	0.0009
A+B :	188	0.200	0.201	0.001	0.0025
A-B :	188	0.040	0.040	0.000	0.0012

s.d(AB): Sw(within run): 0.0009 S(between runs): 0.0014 S/Sw: 1.60

On any given day the calibration is accepted if the values obtained lie within the ranges:

0.191 to 0.209 for A+B  
0.034 to 0.046 for A-B

## RECOVERIES:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Standard Deviation</u>
R1 :	371	0.160	0.157	0.0073
R2 :	374	0.040	0.038	0.0019

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
478	0.000 - 0.040	0.0050	25.12
162	0.040 - 0.100	0.0033	4.72
64	0.100 - 0.200	0.0027	1.83
704	Overall	0.0045	N/A

DETECTION CRITERION: 0.008

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	188	0.001	0.0006
Digested Blank :	557	0.001	0.0006
Standard Cal :	189	302	25.6

# MANGANESE - TOTAL

QUALITY CONTROL DATA FROM 06/06/84 TO 19/12/84

LAB: Rivers and Lakes

Analytical Range: 0.003 to 0.200 mg/L as Mn

## CALIBRATION CONTROL:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Av. Bias</u>	<u>Standard Deviation</u>
A :	66	0.160	0.160	0.000	0.0010
B :	66	0.040	0.040	0.000	0.0007
A+B :	65	0.200	0.200	0.000	0.0013
A-B :	65	0.120	0.120	0.000	0.0012

s.d(AB): Sw(within run): 0.0008      S(between runs): 0.0009      S/Sw: 1.05

On any given day the calibration is accepted if the values obtained lie within the ranges:

0.191 to 0.209 for A+B  
0.114 to 0.126 for A-B

## RECOVERIES:

	<u>Number of Data</u>	<u>Expected Concn</u>	<u>Av. Concn Measured</u>	<u>Standard Deviation</u>
R1 :	132	0.160	0.160	0.0089
R2 :	132	0.040	0.040	0.0009

## DUPLICATES:

<u>Number of Data Pairs</u>	<u>Sample Concn Span</u>	<u>Mean s.d.</u>	<u>Relative s.d. (%)</u>
159	0.000 - 0.040	0.0016	8.13
59	0.040 - 0.100	0.0053	7.62
16	0.100 - 0.200	0.0045	2.97
234	Overall	0.0033	N/A

DETECTION CRITERION: 0.003

## OTHER CHECKS:

	<u>Number of Data</u>	<u>Data Mean</u>	<u>Standard Deviation</u>
Long Term Blank :	66	0.001	0.0005
Digested Blank :	197	0.001	0.0009
Standard Cal :	66	346	17.4